"A study to assess the effect of Buteyko Breathing Technique (BBT) on selected metabolic and pulmonary function parameters among COPD patients visiting pulmonary OPD in AIIMS Bhopal"

Dissertation

Submitted to the Faculty of Nursing

ALL INDIA INSTITUTE OF MEDICAL SCIENCES, BHOPAL

In partial fulfilment of the requirement for the degree of

M.Sc. in Medical Surgical Nursing

(Critical Care Nursing)

By

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Enrollment No: 2200046N07P65006

Under the Guidance of

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July 2024

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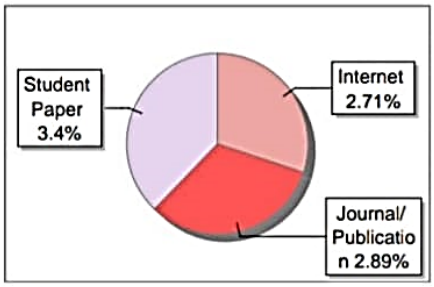

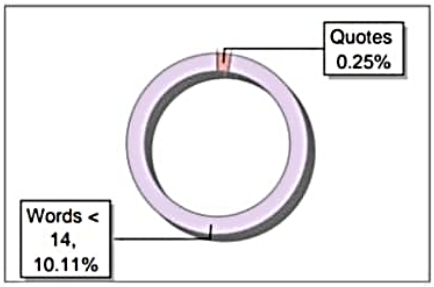

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Saket Nagar, Bhopal – 462020 (M.P)

Institutional Human Ethics Committee- Student Research (IHEC-SR)

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Ref Number: AIIMS/BPL/IHECSR/July/22/MscN/06 **Date:** 28th February 2023

Letter of Permission

Student Investigator: **SONIKA** **Nursing College, AIIMS, Bhopal**	**Guide:** **Mr. R Velmurugan** **Nursing College, AIIMS, Bhopal** **Co-Guides:** **Mrs. Ranjana Verma, Dr. Alkesh Kumar Khurana**

AIIMS, Bhopal Institutional Human Ethics Committee- Student Research (IHEC-SR) in its 7th meeting held on 22nd February 2023 discussed your proposal titled **"A study to assess the effect of Buteyko Breathing Technique(BBT) on selected metabolic and pulmonary function parameter among COPD patients visiting pulmonary OPD in AIIMS Bhopal."** and evaluated it for suitability for your dissertation as required for fulfilment of MSc (Nursing).

Following members attended the meeting:

1. Prof. D. K. Pal, Former HoD Community Medicine, GMC, Bhopal……Chairperson
2. Prof. Rajnish Joshi, Professor of General Medicine, AIIMS, Bhopal……Member
3. Prof. Amit Agrawal, Professor of Neurosurgery, AIIMS, Bhopal……..Member
4. Dr. Sunita Athawale, Professor of Anatomy, AIIMS, Bhopal……..Member
5. Dr. Girish Bhatt, Addl. Professor of Paediatrics, AIIMS, Bhopal……..Member
6. Dr. Ujjawal Khurana, Assoc. Professor of Pathology, AIIMS, Bhopal……..Member
7. Dr. Ankur Joshi, Assoc. Professor of CFM, AIIMS, Bhopal……..Member
8. Mr. Trivesh Goswami, Law Officer, AIIMS Bhopal,……..Member
9. Dr. Shashank Purwar, Professor of Microbiology, AIIMS, Bhopal……Member Secretary

The decision of the committee is as follows:

The AIIMS, Bhopal IHEC-SR approves your research protocol. All research related activities must begin only after the date of this approval. The validity of this approval is till two years from the date of issuance. Please submit a closure report / renewal request before expiration of the validity for this approval.

Shashank Purwar

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ABSTRACT

Introduction: Chronic obstructive pulmonary disease (COPD) is the third leading cause of death worldwide, causing 3.23 million deaths in 2019, it is a common and treatable disease characterized by progressive airflow limitation. All patients with COPD pulmonary rehabilitation programs benefit from programs, improving with respect to both exercise tolerance and symptoms of dyspnea and fatigue.

Objective: To assess the effectiveness of Buteyko breathing technique on selected metabolic and pulmonary function parameter among COPD patients visiting in pulmonary OPD in AIIMS Bhopal.

Methodology: A Randomized control trial was conducted among 60 COPD patients who were selected by using convenient sampling and then randomly allocated into two groups (experimental and control group). For the experimental group, Buteyko breathing technique was taught to practice for 20 minutes, twice daily at home for two weeks. The control group received the routine care. On the 14^{th} day of intervention the selected metabolic and pulmonary function parameter were assessed by the investigator. Data were analysed by using SPSS version 18.

Results: It is observed that there is a significant decrease in Respiratory rate ($p=0.015$), pH ($p=0.0001$), pCO_2 (<0.001), and significant increase in Breath holding time ($p=0.0010$), Peak expiratory flow rate percentage (PEFR%) ($p=0.0012$), HCO_3 ($p=<0.001$) and pO_2 ($p=0.0001$) after the 2 weeks of intervention.

Conclusion: The study findings revealed that, Buteyko breathing technique was effective on selected metabolic and pulmonary function parameter among COPD patients visiting in pulmonary OPD in AIIMS Bhopal.

TABLE OF CONTENT

Sl. No.	CONTENT	PAGE NO.
1	**CHAPTER 1: INTRODUCTION**	
	Background of the study	1
	Significance or need of the study	5
	Problem statement	7
	Research questions	7
	Aim and objective	7
	Hypothesis	8
	Operational definition	8
	Delimitation	9
	Conceptual framework	9
	Summary	12
2	**CHAPTER 2: REVIEW OF LITERATURE**	
	Literature related to obstructive airway disease prevalence	13
	Literature related to obstructive airway disease and respiratory parameters	16
	Literature related to COPD and breathing exercises	18
	Literature related to Buteyko Breathing technique	20
	Literature related to Buteyko breathing technique and COPD	22
	Summary	23
3	**CHAPTER 3: MATERIAL AND METHOD**	
	Research approach	24
	Research design	24
	Randomization	26
	Research variables	26
	Research setting	26
	Population	26
	Sample	

	i. Inclusion and exclusion criteria	27
	ii. Sample size	27
	iii. Sampling technique	28
	Data collection tools and instruments	
	i. Development and description of tool	28
	ii. Validity and reliability of tool	30
	iii. Technique of data collection	30
	Ethical consideration	32
	Pilot study	32
	Procedure of data collection	34
	Plan for data analysis	36
	Summary	36
4	**CHAPTER 4: ANALYSIS**	37
5	**CHAPTER 5: DISCUSSION**	
	Major findings of the study	48
	Discussion	49
	Limitations of the study	52
	Implications of the study	52
	Recommendations	53
	Conclusion	53
	Summary	53
6.	**REFERENCES**	55
7	**ANNEXURES**	60

LIST OD TABLES

Sl. No.	TITLE OF TABLE	PAGE NO.
1	Plan for data analysis	36
2	The frequency and percentage distribution and homogeneity testing of demographic variables	38
3	Comparison of baseline metabolic and pulmonary function parameter before intervention between experimental and control group	41
4	Comparison of frequency & percentage distribution of PEFR% pre and post intervention of both groups	42
5	Comparison of outcome measures between experimental and control group	43
6	Association between pre-interventional measures of selected metabolic and pulmonary function parameter with demographic variables	45

LIST OF FIGURES

Sl. No.	TITLE OF FIGURE	PAGE NO.
1	Conceptual framework based on General System Theory	11
2	Leading cause of death globally	14
3	The schematic presentation of research design	25
4	Flow diagram of data collection procedure	35
5	The comparison of percentage distribution of pre-test and post-test of both groups of PEFR%	42

LIST OF ANNEXURES

Sl. No.	TITLE OF ANNEXURES
1	Letter seeking permission to conduct study
2	Screening tool
3	Tool for data collection
4	Participant information sheet
5	Participant informed consent form
6.	Certificate of translation
7.	List of experts in content validation
8.	Content validity letter with criteria
9.	Certificate of validation
10.	Buteyko breathing technique – intervention protocol
11.	Certificate of Buteyko breathing technique training
12.	Activity worksheet (English)
13.	Activity worksheet (Hindi)
14.	Random number table
15.	Master data sheet with key

LIST OF ABBREVIATIONS

Sl. No.	ABBREVIATIONS	EXPANSION
1	COPD	Chronic obstructive pulmonary disease
2	BBT	Butyeko breathing technique
3	PEFR	Peak expiratory flow rate
4	RR	Respiratory rate
5.	BHT	Breath holding time
6.	OPD	Out-patient department
7.	NCD	Non-communicable disease
8.	BMI	Body Mass Index

CHAPTER 1

INTRODUCTION

The wisest one-word sentence? Breathe.

– Terri Guillemets

BACKGROUND

Chronic obstructive pulmonary disease (COPD) is the third leading cause of death worldwide, causing 3.23 million deaths in 2019.[1] Chronic obstructive pulmonary disease (COPD) is a common and treatable disease characterized by progressive airflow limitation and tissue destruction[2]. It is sometimes called emphysema or chronic bronchitis.[1]

As described in the Global Initiative for Chronic Obstructive Lung Disease (GOLD) criteria handbook, "COPD is a common, preventable, and treatable disease that is characterized by persistent respiratory symptoms and airflow limitation that is due to airway and/or alveolar abnormalities usually caused by significant exposure to noxious particles or gases.[3,4] In 2016, it was the second largest contributor to Disability Adjusted Life Years (DALY) and the top cause of disability among chronic respiratory disorders.[4] Patients with COPD present with overlapping sign and symptoms of emphysema and chronic bronchitis. Patient complains primarily of incapacitating dyspnea and difficulty exhaling air from the lungs thereby reducing the functional capacity, leading to hyperventilation.[3] In later stages of disease, carbon dioxide elimination is impaired, resulting in increased carbon dioxide tension in arterial blood (hypercapnia) leading to respiratory acidosis.

The global scenario of COPD

Chronic obstructive pulmonary disease (COPD) is a pathology with high morbidity and mortality. Approximately 300 million people have COPD globally, with a prevalence of approximately 12.2%.[5] This disease represents the fifth leading cause of death worldwide and it is estimated that by 2030 it will be the fourth.[5,6] Deaths due to chronic obstructive pulmonary disease are particularly infrequent in low-income countries compared to other income groups. 80% of COPD deaths occur in low- and middle-income countries. In addition, the disease represents a high economic burden, with costs of approximately $ 5600 per patient per year, which increase according to the severity of the disease.[5]

Nearly 90% of COPD deaths in those under 70 years of age occur in low- and middle-income countries (LMIC). COPD is the seventh leading cause of poor health worldwide (measured by disability-adjusted life years.[1]

The Indian scenario of COPD

In India, the prevalence of COPD varied, with rural Srinagar in northern India having the highest overall prevalence reported in adults aged 40 years or older (19.3% according to the fixed criteria) and the lowest prevalence reported in south India (4.1% according to the fixed criteria). COPD prevalence was found to be significantly higher in men than women, in Delhi and Srinagar according to the fixed criteria.[6]

The second most common cause of NCD-related mortality in India in 2016 was COPD, with a startling 55.3 million cases. Research from India revealed that the prevalence of COPD rises with age and then rapidly beyond the age of thirty. The estimated incidence of COPD in the population over 30 years of age ranged from 1.6% to 28.3%, whereas the prevalence ranged from 0.1% to 0.9% in the age group of 5 to 29 years. In India, the prevalence of COPD varies throughout states and regions. Evidence from Delhi indicated

a 10% incidence of COPD, whereas Kerala revealed a 6.19% prevalence among the general population. Bangalore's COPD prevalence was reported to be 4.36%.[3]

Risk factors of COPD

Among the numerous risk factors for COPD include smoking, the use of firewood, biomass fuel, and cooking fuel, outdoor air pollution, advancing age, gender, and occupation, lung impairment following tuberculosis, and socioeconomic level. It was discovered that smoking was linked to older age, poorer socioeconomic status, education level, ignorance of the dangers of smoking, and living in a rural location. Combining data from several research revealed that lower socioeconomic level, air pollution, and exposure to tobacco smoke or dust from the workplace all increase the chance of developing COPD.[3]

An umbrella review conducted by Holtjer et. al, in 2023 on nongenetic risk factors for both COPD and adult-onset asthma found that different risk factors included air pollution and chemical exposures, early life exposure, Nutrition and weight status, occupational exposures, Physiological, personal, and socioeconomic characteristics.[7]

A considerable fraction of COPD patients is non-smokers. Apart from smoking, there are several additional risk factors that are also significant in the development of COPD. These include long-term asthma, treated pulmonary tuberculosis, and biomass smoke exposure.[20]

Buteyko Breathing Technique (BBT)

Breathing is the greatest pleasure in life.

– Giovanni Papini

The Buteyko breathing technique is a unique complementary breathing therapy that uses control of breath and holding breathing exercises to treat a varied range of health conditions believed to be connected to hyperventilation and low carbon dioxide.[8]

Buteyko breathing technique is named after Dr. Konstantin Buteyko, a physician and academic from Ukraine who created the therapy in the 1960s.[9,10] He created the Buteyko breathing technique, which aims to reduce breathing by retraining the breathing pattern.[9] The technique has been found to be effective in individuals with asthma and a range of other conditions from anxiety to sleep apnea.[10] For breathing-related ailments such as sinusitis, rhinitis, panic attacks, and chronic obstructive pulmonary disease (COPD), the Buteyko technique is employed.[9] The idea, which gained popularity in Russia, has progressively extended to western nations over the past 20 years, most notably Australia, Europe, New Zealand, and the US.[9,10,11]

Breathing therapy, which makes up the majority of the Buteyko "package," tries to lower hyperventilation by alternating intervals of controlled breathing reduction, or "slow breathing" and "reduced breathing," with breath holding intervals, or "control pauses" and "extended pauses." The method differs slightly between nations and practitioners, but in general, it's a combination of breathing treatment, yoga, and relaxation techniques together with guidance and instruction regarding the use of medications, diet, and overall health.[11]

Because of research, Buteyko has been shown to be a harmless practice. Since the exercises can be done while sitting upright in a chair and are not particularly hard, they are appropriate for most people. The Department of Health's policy of enabling patients to take greater control of their self-management aligns nicely with the Buteyko breathing technique.[9]

SIGNIFICANCE OR NEED OF THE STUDY

Chronic obstructive pulmonary disease (COPD) is an obstructive and progressive airway disease linked to a significant decrease in daily physical activity as well as psychological issues that worsen the patient's quality of life and cause impairment (HRQoL).[12] Patients with COPD typically don't seek medical attention until they have a severe respiratory infection, with dyspnea being the primary symptom. In addition to being linked to misery and a reduced quality of life, COPD is a chronic illness that is costly to treat. Reducing the rising prevalence of COPD is difficult in a resource-poor nation like India.[4] Thus, one practical way to lessen the financial burden of COPD is to prevent the disease from developing. By lowering dyspnea, increasing oxygenation, and preserving a regular respiratory rate, breathing exercises help patients both at rest and during exertion.[1,10]

The physiological anomalies typically seen in COPD patients are mostly linked to aberrant changes in the ventilatory muscle recruitment pattern. This happens as a result of modifications to the rib cage geometry brought on by lung hyperinflation, which modifies the diaphragm muscle's length-tension curve.[13,30] Dyspnea, hypercapnia, and reduced exercise tolerance are frequently caused by weakening of the respiratory muscle in COPD patients.[14,15] Breathing exercises are therefore essential since they can improve respiratory muscle function and possibly lessen the intensity of symptoms in COPD patients.[15]

A review was conducted by A. Bruton and G.T. Lewith[11] in 2005 in a School of Health Professions and Rehabilitation Sciences in United Kingdom (UK), on the Buteyko Breathing Technique for Asthma. The study revealed that the Buteyko breathing technique (BBT), one particular type of breathing therapy, has drawn a lot of interest, although there isn't much solid research to back up its suggestion for asthma sufferers. Just two conference presentations and four published clinical trials have been done to evaluate BBT. The outcomes have not been consistent, despite the fact that all have reported improvements in one or more outcome indicators. BBT is not a standardized therapy modality, as is the case with other therapies. The BBT "package" is complicated because it covers general relaxation, exercise and nutrition, and pharmaceutical use. This makes trying to identify a single mechanism difficult and possibly improper. Therefore, it will need more researches to definitively determine whether BBT is beneficial and, if so, how it may work.

An experimental study conducted by Rachna. D. Arora[9] Visalakshi. H. Subramanian in 2017, with the aim to assess the pre and post changes on outcome measures in control group & in experimental group respectively. The study concluded that for patients with obstructive airway disease, Buteyko breathing proved beneficial in enhancing breath holding, controlling breathing, and reducing breathing effort.

Hence, the researcher decided in this study of to find the effectiveness of Buteyko breathing technique on exercise capacity, metabolic and pulmonary function parameters among COPD patients visiting pulmonary OPD in AIIMS Bhopal. Through this research we can extend the knowledge regarding Buteyko breathing as a complementary therapy and how much it can contribute to reduce the breathing difficulties among COPD patients.

PROBLEM STATEMENT

A study to assess the effect of Buteyko Breathing Technique (BBT) on selected metabolic and pulmonary function parameters among COPD patients visiting pulmonary OPD in AIIMS Bhopal.

RESEARCH QUESTION

1. What is the effect of Buteyko breathing technique on selected metabolic and pulmonary function parameter among COPD patients visiting in pulmonary OPD in AIIMS Bhopal?

AIM AND OBJECTIVES

Aim of the study

The aim of this study is to assess the effectiveness of Buteyko breathing technique on selected metabolic and pulmonary function parameter among COPD patients visiting in pulmonary OPD in AIIMS Bhopal.

Objectives of the study

1. To assess the selected metabolic and pulmonary function parameters among COPD patients visiting pulmonary OPD in AIIMS Bhopal, before intervention.
2. To determine the effect of Buteyko Breathing technique (BBT) on selected metabolic and pulmonary function parameters among COPD patients, before and after intervention.
3. To find association between pre- interventional measures of selected metabolic and pulmonary function parameters and demographic variables.

HYPOTHESIS

H_{01}: There is no significant difference in selected metabolic and pulmonary function parameter among COPD patients before and after intervention at 0.05 level of significance.

H_{02}: There is no association between pre-interventional measures of selected metabolic and pulmonary function parameter among COPD patients at 0.05 level of significance.

ASSUMPTIONS

The information provided by the participant in this study will be considered to be true.

OPERATIONAL DEFINITIONS

1. **Effect:** In this study, it is the outcome of Buteyko breathing technique assessed in terms of change in the selected metabolic and pulmonary function parameter which is evaluated by using post-test measures.

2. **Buteyko Breathing Technique:** In this study, Buteyko Breathing technique is a non-pharmacological complimentary health therapy which was taught to each patient by researcher in pulmonary OPD setting, in which the patient stayed in sitting position and take normal breaths for about 3 min. Then at the end of normal exhalation instructed to pause the breathing until the patient felt the maximum urge to take next inspiration. This session was continued for 20 min.

3. **Selected metabolic parameter:** In this study, the selected metabolic parameter is Analysis of Blood Gases (ABG at room air) – $PaCO_2$, PaO_2, HCO_3, pH.

4. **Selected Pulmonary function parameter:** In this study, the selected pulmonary function parameters are PEFR- Peak Expiratory Flow Rate assessed by Peak Flow meter, Breath holding time assessed using a stopwatch and baseline Respiratory Rate.

5. **COPD Patients:** In this study, the patients who were visiting pulmonary OPD in AIIMS Bhopal with diagnosis of COPD (Chronic Obstructive Pulmonary Disease) by a physician.

DELIMITATION

The study is delimited to the COPD patients visiting in pulmonary OPD in AIIMS Bhopal.

CONCEPTUAL FRAMEWORK

A conceptual framework is a visual or written product that explains either graphically or in narrative form, the main things to be studied, the key factors, concepts, or variables and the presumed relationships among them.[16]

The current study aimed at developing and evaluating the effectiveness of Buteyko breathing technique on selected metabolic and pulmonary function parameter among COPD patients visiting in pulmonary OPD in AIIMS Bhopal. The investigator had adopted conceptual framework developed by a biologist Ludwig von Bertalanffy in 1969. General system theory is primarily concerned with how systems operate, and integrates a broad range of systems by naming and identifying patterns and processes common to all of them.

Input

It is an open system that exchanges energy with the environment and continually attempts to adapt in a holistic manner.

In the present study it refers to the assessment of demographic variables and baseline measures of selected metabolic and pulmonary function parameter among COPD patients.

Process

It refers to the different operational procedure of the programme.

In this study, Buteyko Breathing technique is a non-pharmacological complimentary health therapy which was taught to each patient by researcher in pulmonary OPD setting, in which the patient stayed in sitting position and take normal breaths for about 3 min. Then at the end of normal exhalation instructed to pause the breathing until the patient felt the maximum urge to take next inspiration. This session was continued for 20 min. and practiced by the patient twice daily for 2 weeks at home.

Output

After processing the input, the system returns output to the environment in the form of practising the intervention in their daily lives.

In this study, the investigator assessed the measures of selected metabolic and pulmonary function parameter among COPD patients after 2 weeks.

Feedback

It refers as an internal information about the system functioning as a corrective device. Feedback is not included in this study.

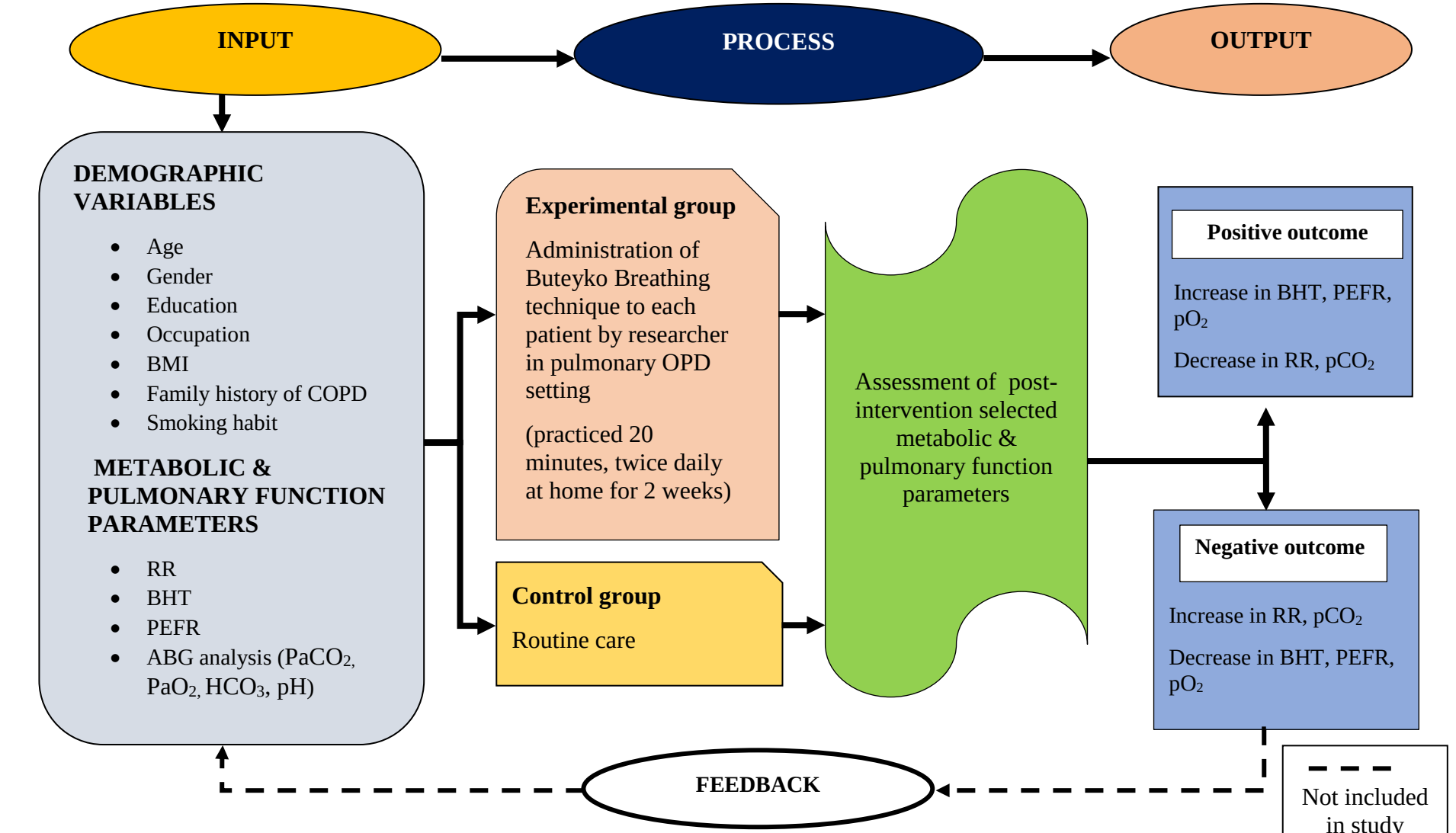

Figure 1: Conceptual Framework based on General System Theory (1969)

Summary of chapter

COPD is characterized by airflow obstruction with breathing-related symptoms such as chronic cough, exertion dyspnea, expectoration, and wheeze [Rakhi Sharma,2019]. Buteyko breathing technique is a complementary health therapy which is being increasingly used for breathing-related conditions.

CHAPTER 2

REVIEW OF LITERATURE

A literature review is a body of test that aims to review the critical points of knowledge on a particular topic of research. It helps to lay the foundation for the study and also inspire new research ideas.[16]

Review of literature is an evaluative repost of information found in the literature related to selected area of study. The review describes, summarizes, evaluates and clarifies this literature. It gives a theoretical base for the research and helps to determine the nature of research.[17]

The search term used for literature review were- Buteyko breathing technique, COPD, obstructive airway disease and respiratory parameters.

Literature related to obstructive airway disease prevalence

A systematic review and meta-analysis conducted by Prashant Jarhyan[6] in 2022, to estimate the prevalence of chronic obstructive pulmonary disease (COPD) and chronic bronchitis in eight countries in South Asia on researches conducted from 1990 to 2021. Findings revealed that, Using the fixed criteria of the Global Initiative for Chronic Obstructive Lung Disease and the lower limit of normal criteria, the estimated pooled prevalence of COPD was 11.1% and 8.0%, respectively. The highest rates of COPD were seen in men and in north India (19.4% and 13.5%, respectively). In India and Pakistan, the estimated pooled prevalence of chronic bronchitis was 5.0% and 3.6%, respectively.

According to World Health Organization (WHO)[18] in 2020, Seven of the top ten causes of death worldwide in 2019 were noncommunicable diseases. However, 74% of fatalities worldwide in 2019 were caused by noncommunicable diseases combined. About 6% of all deaths are attributed to chronic obstructive pulmonary disease, making it the third most common cause of mortality.

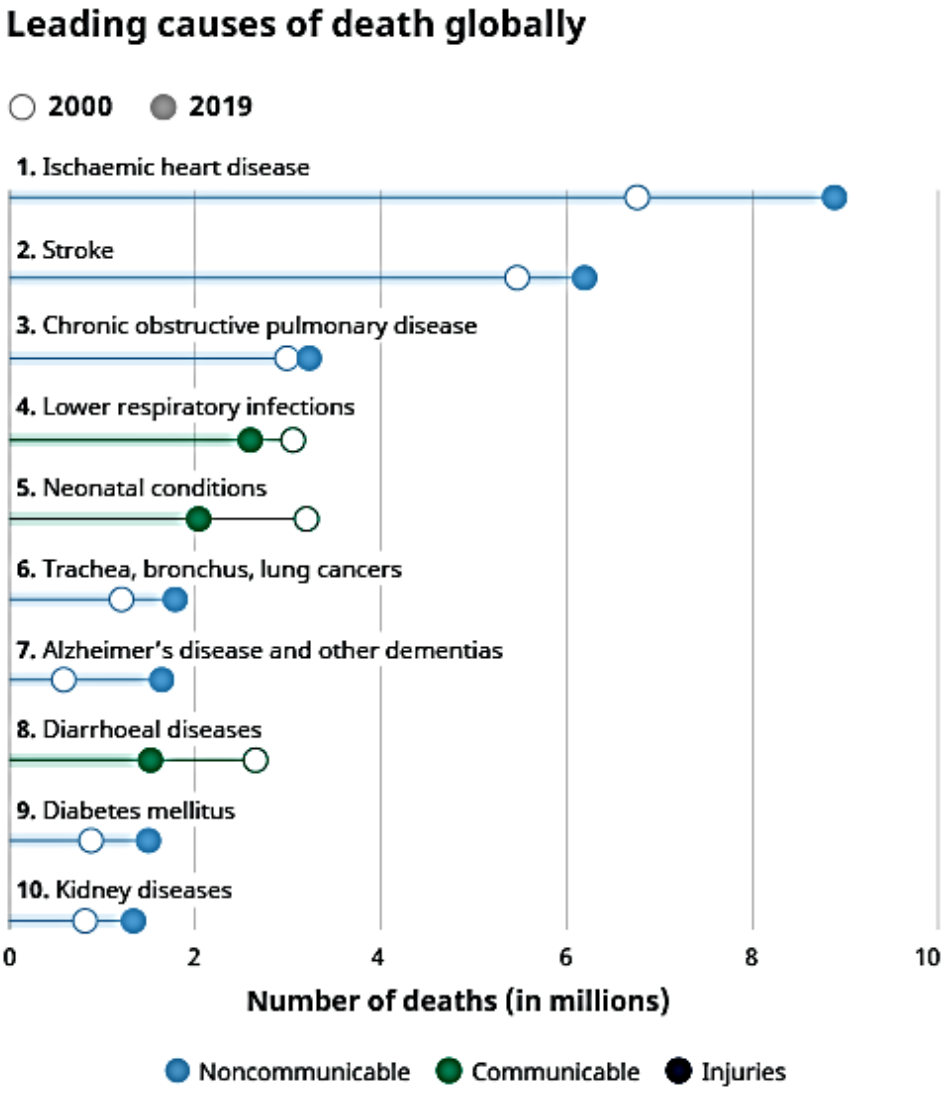

Figure 2: Leading cause of death globally (WHO 2020)[18]

A systematic review and meta-analysis conducted by Daniel RA, Aggarwal P, Kalaivani M, Gupta SK [19] in 2021 in AIIMS, New Delhi, on the prevalence of chronic obstructive pulmonary disease in India from 2011 to 2020. The result showed that, the estimated prevalence in the eight studies that were found (pooled sample of 8,569 people) was 7.4%. In the northern area and the urban area, the frequency was higher among men. Hence in order to diagnose COPD at the primary care level and begin early management, sufficient training and resources should be made available.

A systematic and meta-analysis was conducted by Ashwani Verma[3] et al. in 2021, on researches conducted in India from 2000 to 2020 years on COPD in people over thirty years of age. The results showed that, the prevalence of COPD in Indians aged thirty and older was 7%. Hence, the necessity of COPD-sensitive health literacy programs, which could facilitate the early adoption of self-management techniques that are essential for an improved quality of life.

An update from the Global Burden of Disease was done by GBD Chronic Respiratory Diseases Collaborators[20] in 2019, on the Global burden of chronic respiratory diseases and risk factors from 1990 years to 2019 years. COPD was the most common cause of mortality from CRDs, accounting for 3.3 million (2.9–3.6) deaths of the 212.3 million (200.4–225.1) cases. Smoking was found to be the leading cause of CRD deaths and DALYs worldwide, with air pollution and occupational hazards coming in second and third. It was concluded that there is an urgent need for better preventive, diagnostic, and therapeutic strategies given the high rates of death and disability-adjusted life years (DALYs) in low- and low-middle-income nations.

A community-based study was conducted by Kumar A[21] et al. in 2019, in AIIMS, New Delhi, to determine the prevalence of COPD and associated factors among the elderly. Four hundred forty-nine elderly individuals were selected and assessed by using a

portable spirometer for diagnosis of COPD. Study findings revealed that, there were 42.9% of people with COPD. 33.4 percent of women and 54.5 percent of men were affected by the prevalence. The following factors were strongly linked to COPD: smoking, being older, and having a low body mass index.

An observational cross-sectional study was conducted by Mahmood T[22] et al. in 2015, to find out the proportion of non-smoker individuals among COPD patients and to determine various etiologies in non-smoker COPD patients. Two hundred individuals who were diagnosed with COPD (GOLD guideline) were selected and enrolled in the the study. The results showed that, of the 113 patients with COPD who were not smokers, the greatest proportion (69.03%) had low socioeconomic status. However, exposure to biomass smoke was the most significant risk factor, accounting for 53.98% of the cases. Other significant risk factors included treated pulmonary tuberculosis (32.74%) and long-standing asthma (14.16%). Occupational exposure (9.73%), outdoor air pollution exposure (3.54%), and childhood lower respiratory tract infection (1.77%) were risk factors that did not reach statistical significance. The study concluded that a considerable fraction of COPD patients are non-smokers. Apart from smoking, there are several additional risk factors that are also significant in the development of COPD. These include long-term asthma, treated pulmonary tuberculosis, and biomass smoke exposure.

Literature related to obstructive airway disease and respiratory and metabolic parameters

An experimental study was conducted by El-Nahas[23] et al. in 2019, with the aim to determine the effect of Buteyko breathing technique (BBT) as an adjunctive treatment on blood gases among asthmatic patients. Thirty subjects were selected and enrolled in the

study, were assessed by analysis of arterial blood gases (ABG), control pause test and asthma questionnaire at the beginning of the study and after 8 weeks. The results showed significant changes in ABG values in intervention group (pH 1.32%- HCO3 12.39%- PaCO2 12.82%- PaO2 8.85%) and for control pause (65.68%), while control group showed non-significant changes.

A quasi experimental study was conducted by A. Lurdhu[24] in 2018, with the aim to assess the effectiveness of Nurse Navigated Self-Management Strategies on knowledge, skill and respiratory parameters regarding management of CORD among patients attending OPD. Sixty participants were selected and enrolled in the study and assessed for knowledge, skill and respiratory parameter. The study concluded that when it came to managing chronic obstructive pulmonary diseases, the NNSMS on knowledge, skill, and respiratory parameters was beneficial in raising knowledge and skill levels while lowering respiratory parameters. It can be used to manage patients with CORD and other respiratory conditions at home.

A study was conducted by Kerti M, Balogh Z, Kelemen K, Varga JT[25] et al. in 2017, with the aim to find out the correlation between changes in exercise capacity and other functional markers following pulmonary rehabilitation in COPD and to determine which parameters are more closely related to improvements of exercise tolerance. Three hundred and twenty-seven patients were selected and enrolled in the study and assessed for 6MWT, lung function, chest wall expansion, grip strength, maximal inspiratory pressure, and breath holding time. The results showed improvement in 6MWT, exercise tolerance, dyspnea score (modified Medical Research Dyspnea Scale R^2=-0.54), and health status (COPD Assessment Test R^2=-0.4, p,0.05).

A Systematic Review was conducted by Ahmed M. Al Rajeh, Hurst JR [26] in 2016, to find the effectiveness of monitoring physiological parameters to predict COPD exacerbation including sixteen articles satisfied the predetermined requirements for inclusion. For routine domiciliary monitoring to be used in the prediction of COPD exacerbations, there is currently inadequate data on how physiological parameters change before an exacerbation. Nonetheless, the approach continues to show promise.

A cross-sectional study conducted by Pereira ED[27] et al. in 2008, to determine how respiratory function parameters as assessed by spirometry, arterial blood gas analysis and the six-minute walk test, correlate with the quality of life of COPD patients. Forty-two subjects were selected and enrolled and assessed by using SGRQ, as well as the SF-36 and its component summaries. Study findings showed that there was a correlation between the SGRQ total score and FEV1. It was concluded that reduction in FEV1 is linked to a lower quality of life in COPD patients, as determined by the SGRQ.

Literature related to COPD and breathing exercises

A randomized control trial was conducted by Ceyhan Y, Tekinsoy Kartin P[28] in 2021, to find out the effects of breathing exercises and inhaler training in patients with COPD for four weeks on the severity of dyspnea and life quality. Sixty-seven subjects were selected and enrolled in the study and assessed by a COPD assessment test (CAT), the Modifed Medical Research Council (mMRC) scale, and the St. George's Respiratory Questionnaire scale (SGRQ). Two groups of patients were randomly assigned. Pursed lip breathing exercises and inhaler training were administered to Intervention group 1, while inhaler training alone was provided to Intervention group 2. the study discovered that while the patients' dyspnea severity decreased, their inhaler proficiency and overall

quality of life improved. Drug efficacy and quality of life can be improved by utilizing non-pharmacological techniques to support inhaler therapy.

A systematic review and meta-analysis conducted by Yun R[29] et al. in 2020, to investigate the effect of different breathing exercises on respiratory muscle function, 6- minute walk test (6MWT), and quality of life (QoL) in patients with COPD in Taiwan. The study concluded that through the improvement of 6MWT and inspiratory muscle strength, breathing exercises have been demonstrated to be a helpful strategy for treating individuals with COPD. Breathing exercises, however, did not significantly improve the quality of life for COPD patients.

A systematic review and meta-analysis was conducted by Ubolnuar N[30] et al. in 2018, to update knowledge about how breathing exercises affect a patient's quality of life, exercise capacity, dyspnea, and ventilation in COPD patients including nineteen RCT studies. Respiratory rate improved significantly in the PLB, ventilatory feedback with exercise, DBE, and combination breathing exercises when compared to the control groups. To raise QoL and increase ventilation, one could employ PLB, VF plus exercise, DBE, mixed breathing exercises, and singing.

A systematic review was conducted by Yufan Lu[31] et al. in 2018, to find out how home breathing exercises affect patients with COPD's pulmonary function, respiratory muscle strength, exercise tolerance, dyspnea, and health-related quality of life. The results showed that the intervention techniques included singing, breathing gymnastics, diaphragmatic breathing, and yoga breathing. The modified Medical Research Council dyspnea scale (P <.001), the St George Respiratory Questionnaire (P <.001), maximum inspiratory pressures (P <.001), maximum expiratory pressures (P <.001), 6-min walk distance (P <.001), and the percent of predicted FEV1 (P.02) were all significantly

impacted by home-based breathing exercises when compared to the control group, according to a meta-analysis. The study concluded that breathing exercises can enhance pulmonary function, respiratory muscle strength, exercise capacity, dyspnea, and health-related quality of life in COPD patients as an alternative to home-based pulmonary rehabilitation programs.

An experimental study was conducted by Cecily HS[32] in 2013, to assess the effectiveness of breathing exercises among COPD patients in reduction of dyspnea, improvement of pulmonary functional parameters and Quality of life. Two-hundred subjects were selected and enrolled and assessed for level of dyspnea, QOL and pulmonary functional parameters such as FEV1, FVC, FEV1/ FVC ratio, and PEFR. After pulmonary rehabilitation activities, COPD patients' dyspnea significantly decreased and their pulmonary function and quality of life improved. Thus, deep breathing exercises are a cost-effective and efficient way to help COPD patients' physical capacity and overall wellness.

Literature related to Buteyko Breathing technique

A randomised control trial was conducted by Gopika Gopakumar[33] et al. in 2022, to find out the effectiveness of Buteyko breathing technique on test anxiety among college students. Sixteen students were enrolled and assessed by using west side test anxiety scale 9, PFT and SF36. The study found that both the experimental and control groups' levels of test anxiety were considerably reduced by Buteyko breathing. However, compared to the control group, the experimental group exhibits a considerable decrease in test anxiety.

A randomised controlled trial was conducted by Vagedes K[34] et al. in 2017, with aim to find the effects of BBT in patients with asthma, we investigated whether it led to clinical improvements with correlation to functional parameters. Sixty subjects were selected and

enrolled and randomly divided into two groups (thirty each) of patients with asthma under either BBT or usual therapy (UT) for three months period. The subjects were assessed voluntary control pause (CP) after 3 months, breath hold parameter, forced expiratory volume in 1 s (FEV1), capnovolumetry, exhaled nitric oxide (FeNO), Asthma Control Questionnaire (ACQ) and Nijmegen Questionnaire (NQ), and the use of medication. The study concluded that Despite a significant reduction in respiratory medication, BBT was clinically effective, as seen by the improvement in symptom scores and the little rise in bronchial volume. Given the participants' positive acceptance of the self-controlled Buteyko breathing therapy, it may be deemed a valuable adjunctive tool for asthma treatment that merits greater consideration in clinical settings.

A randomized controlled pilot study was conducted by Vagedes J[35] et al. in 2015, with the aim to find out effectiveness of Buteyko breathing technique in children with asthma. Thirty-two children with partially controlled asthma were selected and randomly assigned into two groups. After a rigorous five-day training, children in the BG practiced at home for three months. The subjects were assessed for bronchodilator reduction, FEV1_AR (at rest), FEV1_ER (after ergometry), FEV1_BR (after bronchospasmolysis), corticosteroid use, FeNO, SpO2, breath-hold test and questionnaire data [Asthma Control Questionnaire and Pediatric Asthma Caregiver's Quality of Life Questionnaire (PACQLQ). The study concluded that the BBT added to standard asthma treatment improves spirometry and parental emotional function but does not, at least not in the near term, result in medication reductions for children with asthma.

A quasi-experimental study was conducted Romella[36] et al. in 2014, with the aim to determine the effectiveness of Buteyko Method in improving asthma control and quality of life of school-age children. The study included 14 participants, aged 7 to 11, who had been diagnosed with bronchial asthma. Answers to the ACQ pre- and post-intervention

and PAQLQ were requested of each group prior to the start of the intervention phase and each week during the follow-up visits. It was concluded that the children of school age who utilize the Buteyko Method as a supplement to traditional asthma treatment within three to four weeks report better asthma control and a higher quality of life.

A randomised controlled trial was conducted by Robert L. Cowie[37] in 2007, with aim to assess the effectiveness of a non-pharmacological intervention in patients with asthma on conventional therapy including inhaled corticosteroid. One twenty-nine patients were selected and enrolled, each patient answered questions on their asthma medication, control of their asthma, and how much their lifestyle was limited by their asthma. Results showed that, in intervention group the proportion with asthma control increased from 40% to 79% and significantly reduced their inhaled corticosteroid therapy compared with the control group. It was concluded that for adult asthma patients, the Buteyko technique, a well-researched and recognized intervention conducted by a chest physiotherapist seem to offer significant benefits.

Literature related to Buteyko breathing technique and COPD

A randomised control trial conducted by Bilal Baig[38] et al. in 2024, with an aim to compare the effectiveness of the Buteyko Breathing Technique (BBT) and the Active Cycle of Breathing Technique (ACBT) in reducing dyspnea and enhancing the quality of life in COPD patients. Forty subjects were selected and assessed for the Dyspnea which was measured using the Modified Borg Scale (MBS), and quality of life assessed using the St. George's Respiratory Questionnaire (SGRQ). The study finding revealed that Dyspnea and quality of life were significantly improved in COPD patients by both BBT

and ACBT, while BBT had a stronger effect. This concluded that BBT might be a better non-pharmacological option for managing COPD.

An Experimental study was conducted by Rakhi Sharma[39] et al. in 2019, with the aim to compare the better effectiveness of Buteyko Breathing Technique and Pursed Lip Breathing in Chronic Obstructive Pulmonary Disease. Fifty COPD diagnosed patients were selected and enrolled, then Group A received Buteyko breathing Technique and Group B received Pursed Lip breathing done for 4weeks. It was concluded that, although both methods are useful in this study, buteyko breathing was determined to be more beneficial than pursed lips breathing after four weeks.

An experimental study conducted by Rachna. D. Arora[10] et al. in 2017, with the aim to assess the pre and post changes on outcome measures in control group & in experimental group respectively. Twenty-eight patients were enrolled after screening and recorded all the outcome measures at baseline and post treatment. Result showed the differences between both groups, statistically significant increase was found in BHT, SBCT, % PV 6MWD, PEFR & significant reduction was found in Resting HR% & Resting RR. The study concluded that for patients with obstructive airway disease, Buteyko breathing proved beneficial in enhancing breath holding, controlling breathing, and lessening breathing effort.

Summary of chapter

This chapter deals with the review of literature. By reviewing different literature, it is evident that the Buteyko breathing technique is a complementary therapy for the chronic obstructive pulmonary disease (COPD) patients with many positive and relaxing effects.

CHAPTER 3

MATERIALS AND METHODS

Research methodology is the systematic way to solve problems. According to Kothari (1990), "it includes the steps that the researcher adopts to study his problems with the logic behind it." It illustrates how the process of gathering reliable and accurate data for an intervention should be organized overall.

This chapter provides a brief explanation of the research methodology that was employed by the author to conduct this study. This chapter includes the sample, sampling procedure, study environment, research methodology, and research design. It also covers the tool's creation, data gathering protocol, and data analysis strategy.

RESEARCH APPROACH

Quantitative research approach was adopted for this study.

RESEARCH DESIGN

Experimental research design (Randomized Control Trial) was adopted for this study. In this study the participants were randomized to (allocation ratio 1:1) two groups. The experimental group received Buteyko breathing technique and the control group did not receive any intervention.

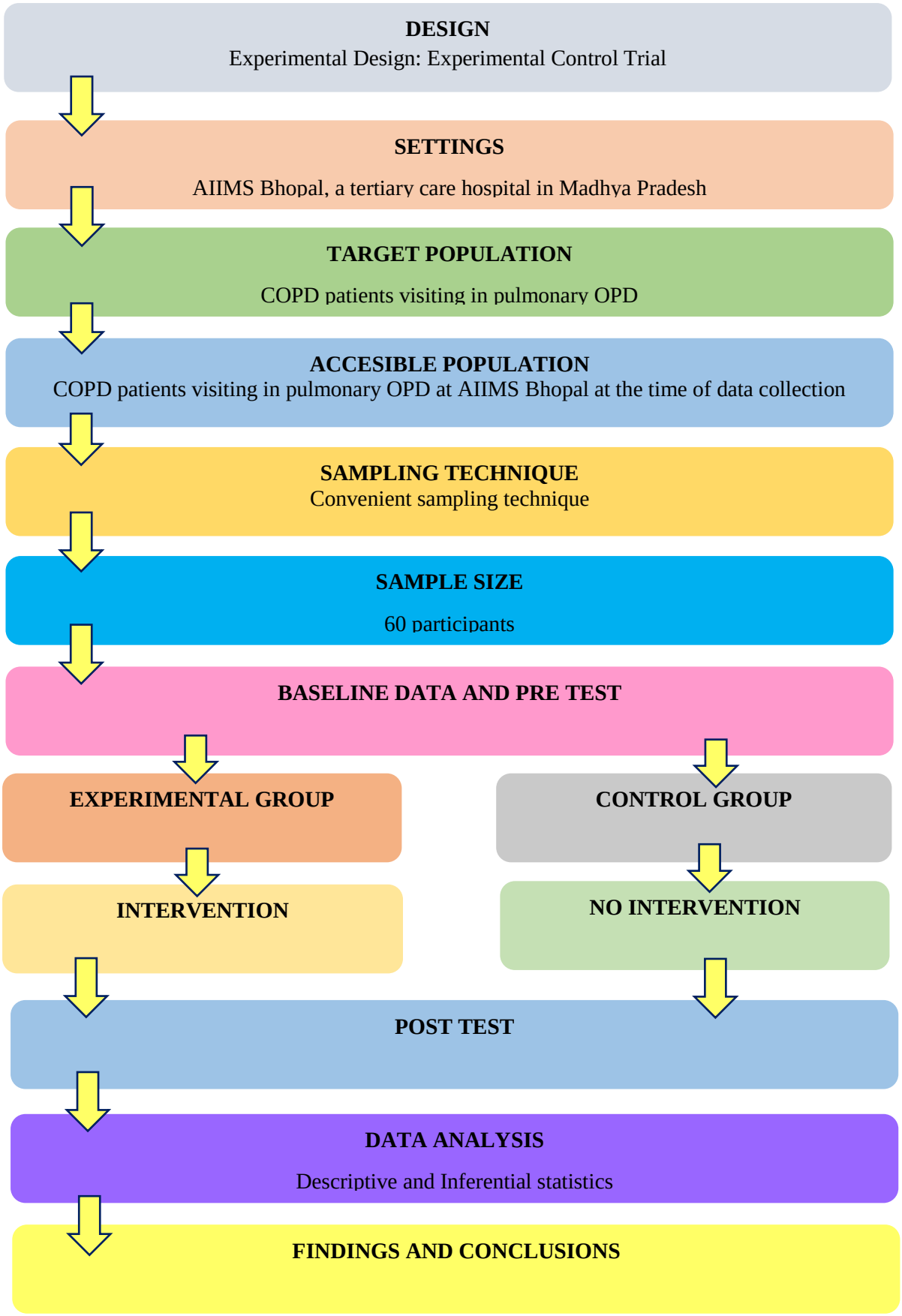

Figure 3: The schematic presentation of research design

RANDOMIZATION

Simple randomization with allocation ratio 1:1 was used for the study.

www.randomization.com was used to help create the randomized list and randomization sequence. The researcher's selection bias was reduced by using allocation concealment. The Sequentially Numbered, Opaque Sealed Envelopes (SNOSE) allocation concealment approach was used. The interventional group or control group, whose identity was undisclosed to the researcher, was noted on each sequentially numbered envelope. The participants were asked to choose one envelope at random from the bundle after giving their assent, and based on their choice, they were placed in either the experimental or control group.

RESEARCH VARIABLES

Dependent variables: - Pulmonary function parameter (baseline Respiratory rate, Breath holding time, PEFR- Peak expiratory flow rate), Metabolic parameter (ABG analysis- $paCO_2$, paO_2, HCO_3, pH).

Independent variables: - Buteyko Breathing Technique (BBT)

Demographic variables: - This includes age, gender, educational qualification, occupation, hight, weight, BMI, family history of COPD, smoking habit.

RESEARCH SETTING

The research setting of this study was pulmonary OPD at AIIMS Bhopal.

POPULATION

The COPD patients visiting in pulmonary OPD at AIIMS Bhopal.

SAMPLE

INCLUSION AND EXCLUSION CRITERIA

Inclusion criteria

- Patients who are above 18 years of age visiting pulmonary OPD of AIIMS Bhopal.
- Patient diagnosed with COPD
- Patients who understand Hindi or English or both.
- Patient who are willing to participate.

Exclusion criteria

- Patient who are not present at the time of data collection/lost to follow-up.
- Patients in COPD exacerbation needing hospitalization.
- Patient ever participated in breathing exercises.
- Patient undergone any spinal surgery in past 2 years.
- Patient having other disease like TB, Heart failure, renal failure, neurological disease or psychiatric disease

SAMPLE SIZE

The sample size is calculated using the previous study titled "to study the effect of Buteyko breathing technique in patients with obstructive airway disease", the mean difference and SD of primary outcome measure (PEFR) in intervention group was 8.46±8.98[10].

$$n \geq \frac{(Z_{1-\alpha/2} + Z_{1-\beta})^2 \ (\sigma_1^2 + \sigma_2^2 / r)}{(\mu_1 - \mu_2)^2}$$

$n = (1.96+0.80)^2 (8.9^2 + 7.5^2) / (8.4-2.5)^2$

$= 7.61*135.2/34.8$

$= 29.5$ in each group

$N = 60$

Alpha(α): type 1 error rate

Beta (β): Type 2 error rate

μ_1: Expected mean of the outcome in group 1

σ_1: Expected standard deviation of the outcome in group 1

μ_2: Expected mean of the outcome in group 2

σ_2: Expected standard deviation of the outcome in group 2

r: Sample size ratio Group 2/ Group 1

In pilot study 10% of the total sample size will be used, 6.

Sampling Technique

Convenient sampling technique were used to select participants for the study.

DATA COLLECTION TOOLS/INSTRUMENTS (Annexure No: 2 & 3**)**

Development & description of tools

The following steps were undertaken in tool development:

1. Extensive review of literature regarding Buteyko breathing technique among COPD patients.
2. Selection of tool for the assessment of effectiveness of Buteyko breathing technique (clinical recording sheet)
3. Development of screening tool (phase one of study) on the basis of inclusion and exclusion criteria.

4. Development of demographic and clinical record sheet (phase two of study) based on literature review.
5. Content validation. (Annexure No: 9)
6. Tool modification based on the suggestions of guide, co-guide and experts
7. Tool translation into regional language (Hindi) and reverse translated (to English) (Annexure-4 & 5)
8. Reliability testing
9. Finalizing of tool

Tool 1: the screening tool included, participant identification number and 09 questions on the basis of inclusion and exclusion criteria (Annexure No: 2). The participants were instructed to consult physician before giving full responses to the questionnaire.

Tool 2: Included participant identification number and pre-test and post-test clinical record sheet. (Annexure No: 3).

Section 1: questionnaire to assess demographic data

This included 9 items namely, age, gender, educational qualification, occupation, height, weight, BMI, family history of COPD, smoking habit.

Section 2: Clinical sheet for recording Pulmonary Function Parameter

This include 3 items namely, baseline respiratory rate, breath holding time, PEFR (peak expiratory flow rate).

Section 3: Clinical sheet for recording Metabolic Parameter

This include ABG analysis- pO2, PaCO2, HCO3, pH

Technique of data collection

Data was collected by questionnaire method. The researcher filled the questionnaire for each participant. The phase one (screening phase) was conducted with questionnaire based on inclusion and exclusion criteria. The second phase was conducted only with offline questionnaire containing demographic data, clinical sheet for recording metabolic and pulmonary function parameter.

Validity & reliability of tools

Validity

Content validity of the tool was obtained from 10 experts in the field of nursing and medicine. (Annexure No: 8)

Individual item content validity Index (I-CVI) was calculated by taking the option score 3 and 4 (highly relevant and quite relevant) and Scale-Content Validity Index (S-CVI) calculated by taking average of I-CVI

a. S-CVI for Section 1: 0.95
b. S-CVI for Section 2: 1
c. S-CVI for Section 3: 1

Reliability

In current setting reliability of clinical sheet for pulmonary function parameter established by inter-rate/inter-observer method on 05 study participants (r = 0.93)

DESCRIPTION OF THE INTERVENTION (Annexure No: 11)

Buteyko breathing technique aims to reduce hyperventilation through periods of controlled reduction in breathing, known as 'slow breathing' & 'reduced breathing', combined with periods of breath holding, known as 'control pause'.

Procedure

Patient preparation

- Greet the patient and introduce yourself.
- Explain the procedure to the patient.
- Place the patient in comfortable sitting

Environment preparation

- Time should be convenient for investigator and the participant
- Area should be well lighted.
- Room should be warm enough to be comfortable for the client
- Positioning of the patient in upright position on a chair

Phase 1- Pre-exercise phase (3 mins)

- Mindful breathing for 1 min
- Breath in with neck extension and breath out with neck flexion for 1 min.
- Again, mindful breathing for 1 min.

Phase 2- Exercise phase (15 min)

Step 1) Gently breath out through nose.

Step 2) Pinch nose with fingers to hold breath

Step 3) Hold breath as long as possible

Step 4) Release nose and resume breathing

Step 5) Calm breathing as soon as possible

Step 6) Wait 30-60 seconds. Repeat twelve times.

Phase 3- Post exercise phase (2 min)

Take a rest with normal breathing for 2 min.

ETHICAL CONSIDERATION

Ethical clearance obtained from Institutional Human Ethics Committee- Student Research (Ref Number: AIIMS/BPL/IHECSR/July/22/MscN/06) and permission to conduct study obtained from concerned hospital authority. Written informed consent (Annexure No: 5) obtained from then participant after giving participant information sheet (Annexure No: 4) having full disclosure regarding study participation.

Confidentiality of information participation and right to withdraw at any point of study was assured.

PILOT STUDY

- Pilot study was conducted in AIIMS Bhopal for a period from 13th September 2023 to 27th September 2023. Researcher was trained and certified for providing Buteyko breathing technique before enrolling the first participant for pilot study (Annexure No: 12). Following the screening phase, eight participants who satisfied the eligibility requirements were easily chosen, and they were then randomly assigned, using a computer-generated randomization list obtained from www.randomization.com, to the

experimental and control groups at a ratio of 1:1. Sequentially Numbered, Opaque Sealed Envelope (SNOSE) was the allocation concealment strategy employed in this investigation. Intervention was provided by the researcher after Buteyko breathing technique training. Experimental group got intervention (Buteyko breathing technique) which was performed in a quite and a well-lit room with adequate privacy, which include 3 phases of 20 min. The intervention was provided by making the patient sit in upright position on a chair. Then phase 1 (pre-exercise phase) was given to the patient for 3 minutes with mindful breathing and neck movements. Then phase 2 (exercise phase) was given for 15 minutes in which patient had to gently breath out through nose and pinch their nose with fingers to hold breath as long as possible then release nose and resume breathing. Calm breathing as soon as possible and take short rest period for 30-60 seconds and repeat this cycle twelve times. Then 2 minute of phase 3 (exercise phase) in which the patient takes a rest with normal breathing for 2 minutes. Post test was taken on the day after 2 weeks of at home practice by using peak flow meter and stopwatch.

It was concluded that the objectives of the study were attained through various statistical method and interpretation. There was no significant difference between metabolic and pulmonary function parameter in post test experimental and control group ($p>0.05$). The fisher exact test was showing no significant association between pre-test measures of selected metabolic and pulmonary function parameters with demographic variables of COPD patients visiting in pulmonary OPD in AIIMS Bhopal ($p<0.05$).

PROCEDURE OF DATA COLLECTION

The main data collection was from 21/09/2023 to 30/10/23. The phase 1 of the study was conducted by questionnaire method. The screening tool was distributed to overall 63 COPD patients. Total 60 COPD patients participated in the phase one after obtaining informed consent. Rest of the participants were screened out in the first phase of the study. Out of 63 COPD patients 60 were eligible for the phase two of the study.is shoed in the fig. Sixty participants were selected using convenient sampling method after informed consent. Participants were clearly informed about the procedure and intervention before obtaining consent. With the computer-generated randomized list (Annexure-13), participants were allocated to experimental and control group with allocation ratio of 1:1. Allocation concealment mechanism used in the present study was Sequentially Numbered, Opaque Sealed Envelope (SNOSE). The participants in experimental group receive Buteyko breathing technique and no intervention was received by the participants in the control group. Data collection was done by using demographic sheet and clinical sheet for recording metabolic and pulmonary function parameter. The post test was collected after 2 weeks of at home practice of intervention that is one the 15^{th} day. There was no drop out of participants during the study. All the participants completed the course of study successfully.

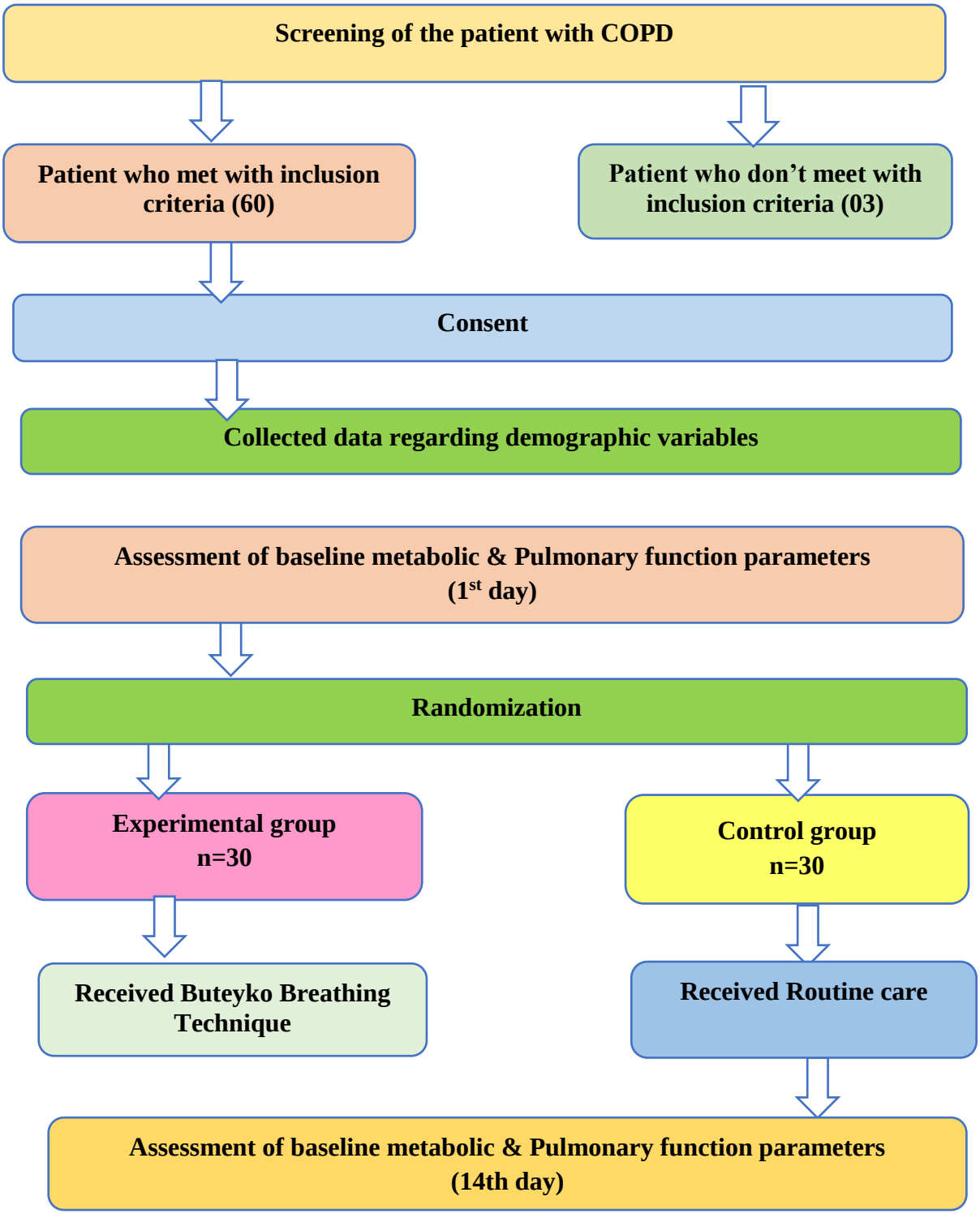
Screening of the patient with COPD
Patient who met with inclusion criteria (60)
Patient who don't meet with inclusion criteria (03)
Consent
Collected data regarding demographic variables
Assessment of baseline metabolic & Pulmonary function parameters (1st day)
Randomization
Experimental group n=30
Control group n=30
Received Buteyko Breathing Technique
Received Routine care
Assessment of baseline metabolic & Pulmonary function parameters (14th day)

Figure 4: Flow diagram of data collection procedure

PLAN FOR DATA ANALYSIS

Table 1: Plan for data analysis

S.NO	PARAMETER	STATISTICAL TEST
1	Distribution of Demographic	Frequency percentage distribution Fisher Exact test
2	**Objective 1**- To assess the selected metabolic and pulmonary function parameters among COPD patients in experimental and control group.	Mean Standard deviation Leven's Test
3	**Objective 2**- To determine the effect of Buteyko Breathing Technique (BBT) on selected metabolic and pulmonary function parameters among COPD patients visiting in pulmonary OPD in AIIMS Bhopal.	Mean & SD Unpaired T test
4	**Objective 3** - To associate pre-test measures of selected metabolic and pulmonary function parameter with demographic variables of COPD patients visiting in pulmonary OPD in AIIMS Bhopal.	T test ANOVA

Summary of chapter

This chapter deals with the material and methods used for the current study. It includes research approach, research design, research variables, research setting, population, the sample, data collection tool, description of intervention, ethical consideration, pilot study, procedure of data collection, and the plan for data analysis.

CHAPTER 4

RESULT

Data analysis is a process for obtaining raw data and converting it into information useful for decision-making by users. Data is collected and analyzed to answer questions, test hypothesis or disprove theories.[16]

In this study, the data collected from 60 participants were analysed using SPSS software (version 18).

The findings are classified in the following sessions:

Section 1: Description of demographic data

Section 2: Description of baseline metabolic and pulmonary function parameter, among COPD patients visiting pulmonary OPD, before intervention.

Section 3: Comparison of Peak Expiratory Flow Rate (PEFR) in experimental and control group, before and after intervention.

Section 4: Effectiveness of Buteyko breathing technique among COPD patients

Section 5: Association between pre-interventional measures of selected metabolic and pulmonary function parameter with demographic variables

Section 1: Description of demographic data

Table 2: The frequency, percentage and homogeneity of demographic variables in intervention and control group

N = 60

S.No.	Demographic variables	Intervention group n=30		Control group n=30		χ^2/ fisher exact test (df)	P value
		F	%	F	%		
1.	**Age (in years)**					2.88*	0.23 (NS)
	41-50	2	6.7	0	0		
	51-60	18	60	15	50		
	61-70	10	33.3	15	50		
2.	**Gender**					1.17	0.27 (NS)
	Male	27	90	24	80		
	Female	3	10	6	20		
3.	**Educational qualification**					4.47*	0.48 (NS)
	Graduate or Postgraduate	1	3.3	0	0		
	Intermediate or post high school diploma	3	10	1	3.3		
	High school certificate	8	26.7	5	16.7		
	Middle school certificate	14	46.7	15	50		
	Primary school certificate	2	6.7	5	16.7		
	Illiterate	2	6.7	4	13.3		
4.	**Occupation**					2.90*	0.57 (NS)
	Clerical, shop owner	3	10	2	6.7		
	Skilled worker	2	6.7	0	0		
	Semi- skilled worker	12	40	15	50		
	Unskilled worker	6	20	4	13.3		
	Unemployed	7	23	9	30		

5.	**BMI (Body Mass Index)**					5.779	0.12 (NS)
	Underweight <18.5	9	30	17	56.7		
	Normal 18.6-22.9	18	60	13	43.3		
	Overweight 23-24.9	1	3.3	0	0		
	Obese >25	2	6.7	0	0		
6.	**Family history of COPD**					Constant	
	Yes	0	0%	0	0%		
	No	30	100%	30	100%		
7.	**Cigarette smoking habit**					0.162	0.68 (NS)
	Yes	27	90	26	86.7		
	No	3	10	4	13.3		

*** = Fishers exact test, NS = Not Significant, F = Frequency, % = Percentage, χ^2 = chi square**

Table 2 presents the frequency and percentage distribution of the demographic variables of COPD patients visiting pulmonary OPD in experimental and control group. In the experimental group, the lowest and maximum ages varied from 41 to 50 years and 51 to 60 years, respectively, whereas the equal age group ranged from 51 to 70 years. Among the thirty participants in the experimental group, twenty-seven (90%) were males on the other side in control group twenty-four (80%) were males.

In current study maximum participants, that is fourteen participants (46.7) in experimental group and fifteen participants (50%), were having middle school educational qualification.

Twelve participants (40%) among experimental group and fifteen participants (50%) among control group, were semi-skilled worker in occupation.

In experimental group most of the participants were having normal BMI about eighteen participants (60%), rest nine participants (30%) were underweight, two participants (6.7%) were obese and one participant (3.3%) was overweight. In control group most of

the participants were underweight about seventeen participants (56.7%) and rest thirteen participants (43.4%) were having normal BMI. All the participants, that is thirty participants (100%) in experimental as well as in control group were not having a family history of COPD. Majority of the participants, about twenty-seven participants (90%) and twenty-six participants (86.7%) were smokers in both experimental and control group, respectively.

For homogeneity, chi square test and Fisher exact test was used, test is applied to single categorical variables from two or more different populations to determine whether frequency counts are distributed identically across different populations.

The p value ($p>0.05$) suggests that there is no significant difference in experimental & control group regarding the demographic variables

Section 2: Description of baseline metabolic and pulmonary function parameter, among COPD patients visiting pulmonary OPD, before intervention.

Table 3: Comparison of baseline metabolic and pulmonary function parameter before intervention between experimental and control group

N = 60

	Group		Mean	Std. Deviation	Levene's statistics F	p value
Pulmonary function parameter	**RR**	Intervention	25.96	5.14	0.243	0.624 (NS)
		Control	26.50	5.60		
	BHT	Intervention	14.00	3.35	0.018	0.893 (NS)
		Control	13.73	3.30		
	PEFR%	Intervention	66.46	7.60	0.012	0.913 (NS)
		Control	63.46	7.72		
Metabolic parameters	**pH**	Intervention	7.50	0.03	0.251	0.618 (NS)
		Control	7.49	0.03		
	HCO3	Intervention	19.03	0.89	1.279	0.263 (NS)
		Control	19.15	0.44		
	pCO2	Intervention	47.81	1.34	7.880	0.007 (S)
		Control	45.39	1.86		
	Po2	Intervention	71.66	1.81	0.243	0.624 (NS)
		Control	73.95	1.40		

NS = Not Significant, S = Significant, RR = Respiratory Rate, BHT= Breath holding time, PEFR%= Peak Expiratory Flow Rate

Table 3 is representing the pulmonary function parameters and metabolic parameters, among COPD patients visiting pulmonary OPD in AIIMS Bhopal, before intervention using mean and standard deviation as most of the groups.

Levene's test was applied to determine the homogeneity for metabolic and pulmonary function parameter across the population. The p value ($p>0.05$) suggests that there is no

significant difference in experimental & control group regarding the metabolic and pulmonary function parameters.

Section 3: Comparison of Peak Expiratory Flow Rate (PEFR) before and after intervention in experimental and control group.

Table 4: Comparison of frequency & percentage distribution of PEFR% pre and post intervention of both groups.

N = 60

Criteria measure of PEFR% score				
Score level	**Pre- intervention**		**Post- intervention**	
	Experimental F, (%)	**Control F, (%)**	**Experimental F, (%)**	**Control F, (%)**
Normal (81-100)	0 (0%)	0 (0%)	3 (10%)	1 (3.3%)
Moderate (50-80)	28 (93.3%)	27 (90%)	27 (90%)	29 (96.7%)
Severe (<50)	2 (6.7%)	3 (10%)	0 (0%)	0 (0%)

F = Frequency, % = Percentage

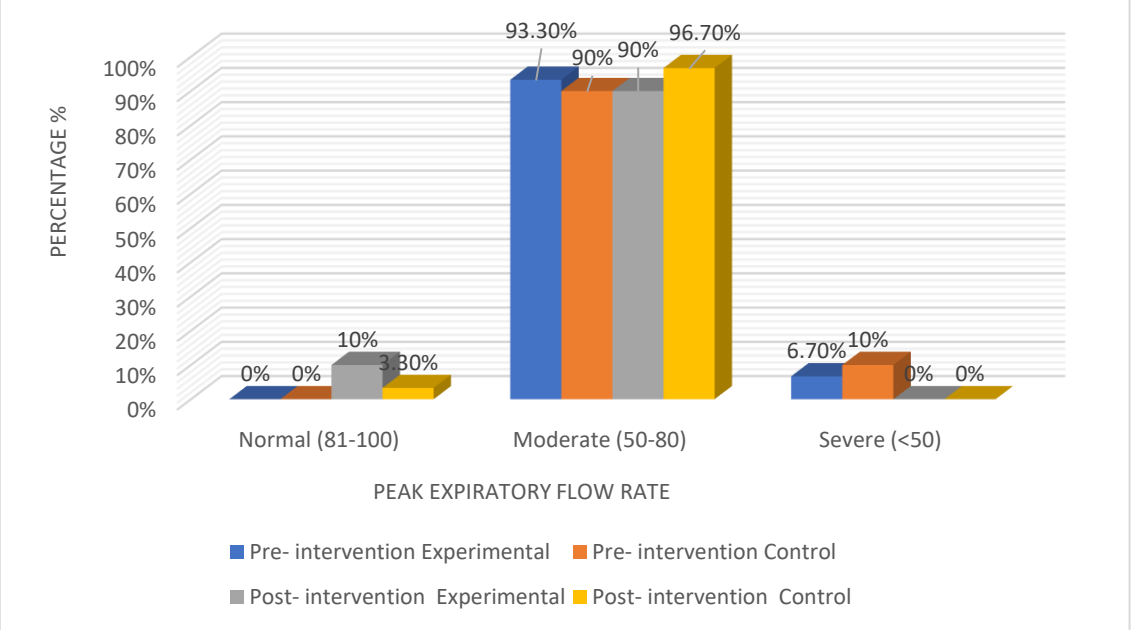

Figure 5: The comparison of percentage distribution of PEFR% between pre and post intervention of both groups.

Table 4 and Figure 5 represents that, for the Moderate PEFR% range (80-50%), the majority of participants in both the experimental and control groups had PEFR% falling into this category before the intervention, representing 93.3% and 90%, respectively. After the intervention, there was a decrease in the percentage of participants in the experimental group to 90%, with 3 participants (10%) moving into the Normal PEFR% range. The control group saw an increase to 96.7%, with 1 participant (3.3%) moving into the Normal PEFR% range.

Section 4: Effectiveness of Buteyko breathing technique among COPD patients

Table 5: Comparison of outcome measures between experimental and control group

N = 60

Unpaired t test		Mean difference	t	P value
Pulmonary function parameters	**Respiratory rate**	3.15	2.50	0.015 (S)
	Breath holding time	2.77	3.49	0.0010 (S)
	PEFR%	6.92	3.43	0.0012 (S)
Metabolic parameters	**pH**	0.08	7.51	<0.001 (S)
	HCO3	0.08	5.86	<0.001 (S)
	pCO2	2.66	5.24	<0.001 (S)
	pO2	1.76	4.17	0.0001 (S)

Table value at 0.05 is 2.01, S = Significant

To determine the effect of Buteyko Breathing Technique (BBT) on selected metabolic and pulmonary function parameters among COPD patients, the following null hypothesis was stated and tested at 0.05 level of significance.

$H0_1$: There is no significant difference in selected metabolic and pulmonary function parameter among COPD patients after intervention at 0.05 level of significance.

Unpaired t test is performed to check is there any significant difference in the outcome measures of metabolic and pulmonary function parameters between experimental and control group.

It is observed that there is a significant decrease in Respiratory rate (p=0.015), pH (p=0.0001), pCO_2 (<0.001), and significant increase in Breath holding time (p=0.0010), Peak expiratory flow rate percentage (PEFR%) (p=0.0012), HCO_3 (p=<0.001) and pO_2 (p=0.0001) [Table 5]

Thus, null hypothesis was rejected and accepted the alternative hypothesis. That there is a significant difference in selected metabolic and pulmonary function parameter among COPD patients after intervention at 0.05 level of significance.

Hence it is concluded that the intervention is effective on the metabolic and pulmonary function parameters in experimental group.

Section 5: Association between pre-interventional measures of selected metabolic and pulmonary function parameter with demographic variables

Table 6: Association between pre-interventional measures of selected metabolic and pulmonary function parameter with demographic variables

N = 60

Variable		Experimental Group			Control Group		
		RR	BHT	PEFR%	RR	BHT	PEFR%
Age	F test	21.22	19.07	23.11	20.12	30.51	23.57
	P Value	0.6	0.33	0.23	0.19	0.08	0.718
Gender	T test	10.7	9.4	10.46	6.26	8.74	10.5
	P Value	0.6	0.51	0.51	0.54	0.69	0.34
Education	F test	61.5	49.55	58.5	31.8	46.8	46.08
	P Value	0.4	0.53	0.44	0.54	0.58	0.23
Occupation	F test	41.8	41.09	37.85	28.69	29.5	28.89
	P Value	0.56	0.02*	0.87	0.03*	0.9	0.79
BMI	F test	42.08	31.57	36.31	5.23	10.27	10.84
	P Value	0.1	0.401	0.48	0.88	0.39	0.33
Smoking	T test	10.7	9.43	10.46	6.7	8.6	9.4
	P Value	0.6	0.51	0.51	0.58	0.77	0.6

*** = Significant**

T test and ANOVA are performed to check any significant association exist between pre-interventional measures of selected metabolic and pulmonary parameters with demographic variables.

For that following null hypothesis was stated and tested at 0.05 level of significance

H_{02}: There is no association between pre-interventional measures of selected metabolic and pulmonary parameters with demographic variables of COPD patients visiting in pulmonary OPD in AIIMS Bhopal.

Table 6 is showing the association between pre-interventional measures of selected metabolic and pulmonary parameters with demographic variables of COPD patients. The association was significant at 0.05 level of significance. Thus, in the present study it is observed that occupation is significantly associated with BHT and RR in experimental group and control group, respectively.

SUMMARY

The chapter dealt with the presentation of analysis and interpretation of the data collected for the study. The analysis was presented in 5 parts. The mean difference of pulmonary function parameters like respiratory rate is 3.15, Breath holding time is 2.77, PEFR% is 6.92, and metabolic parameters like pH is 0.08, HCO3 is 0.08, pCO2 is 2.66, pO2 is 1.76, respectively.

Buteyko breathing technique was effective on selected metabolic and pulmonary function parameter among COPD patients visiting in pulmonary OPD in AIIMS Bhopal.

CHAPTER 5

DISCUSSION

This chapter deals with the major findings of the study. The findings are discussed in the context of available literature, limitations, implications, conclusions and recommendations are drawn.

Major findings of the study

1. The mean of respiratory rate before intervention in experimental and control group is 25.96±5.14 and 26.50±5.60 respectively.
2. The mean of breath holding time before intervention in experimental and control group is 14±3.35 and 13.73±3.30 respectively.
3. The mean of PEFR% before intervention in experimental and control group is 66.46±7.60 and 63.46±7.72 respectively.
4. The mean of pCO_2 before intervention in experimental and control group is 47.81±1.34 and 45.39±1.86 respectively.
5. There is a significant decrease in Respiratory rate (p=0.015), pH (p=0.0001), pCO_2 (<0.001), and significant increase in Breath holding time (p=0.0010), Peak expiratory flow rate percentage (PEFR%) (p=0.0012), HCO_3 (p=<0.001) and pO_2 (p=0.0001) between experimental and control group after the 2 weeks of intervention.
6. It is observed that occupation is significantly associated with BHT and RR in experimental group and control group, respectively.

DISCUSSION

1. Description of demographic variables of participants

In present study experimental group is having 90% of males and 10% of females, in control group 80% of them were males and 20% of them were females with most of the participants (60%) coming under the age group of 51 to 60 years in experimental group while in control group half of them coming under 51 to 60 age group and another half coming under 61 to 70 age group.

Similar distribution can be seen in the study conducted by Arora RD, Subramanian VH in Mumbai, India, where more than half of the participant were males (64.29%) with mean age 48.86 ± 14.11 years.[10] And a study conducted in Pakistan have shown gender distribution of 70% males and 30% females with mean age 59.70 ± 5.89 years[38] and the study conducted by Rakhi Sharma, in Dehradun, India, the mean age was 62.68 years.[39]

In contrary, a study conducted by Lourdu A in 2018, shows different gender distribution among the population with majority of the population being females, 56.7% in experimental group and 60% in control group.[24]

In present study, 46.7% of them were having middle school education in experimental group and 50% in control group. In experimental group about 40% were semi-skilled worker by occupation whereas in control group half of them were semi-skilled worker by occupation. In a study conducted by Lourdu A[24] in 2018, shows majority of the population is having degree/professional education in experimental group while high school education in control group.

In current study, in experimental group most of the participants (60%) had normal Body Mass Index, in control group 56.7% participants had underweight Body Mass Index. Majority of the participants had history of cigarette smoking in both experimental group

(90%) and control group (86.7%). Similarly, in study conducted by Arora RD, the experimental group showed normal BMI with mean BMI 21.76 ± 3.675.[10]

In contrary, a study conducted by Lourdu A[24] in 2018, shows many of the samples were non-smokers in both the groups but had normal BMI.

2. Description of respiratory parameters before intervention and the effect of Buteyko breathing technique on respiratory parameters

The mean of respiratory rate before intervention in experimental and control group is 25.96±5.14 and 26.50±5.60 respectively. The mean of breath holding time before intervention in experimental and control group is 14±3.35 and 13.73±3.30 respectively.

Similarly, in study conducted by Arora RD, the mean baseline respiratory rate and breath holding time in experimental group was shown 29.07 ± 1.97 and 12.71 ± 2.33.[10] also in a study conducted by Lourdu A[24] in 2018, majority of the population had respiratory rate between 21 to 28 (breath per minute) in both the groups.

In current study, moderate PEFR% range (80-50%), the majority of participants in both the experimental and control groups had PEFR% falling into this category before the intervention, representing 93.3% and 90%, respectively. Similarly, in study conducted by Arora RD, in control group, 50% had moderate and 50% patients had severe airway obstruction. In experimental group, 57.14% subjects had moderate and 42.86% subjects had severe airway obstruction.[10] Also in a study conducted by Lourdu A[24] in 2018, showed the majority of samples in the experimental group showed moderate PEFR levels on the pretest, but by the posttest, those levels were improved to mild levels. The majority of samples in the control group's pre- and post-test had modest PEFR percentages.

In current study, it is observed that there is a significant decrease in Respiratory rate (p=0.015), pH (p=0.0001), pCO_2 (<0.001), and significant increase in Breath holding time (p=0.0010), Peak expiratory flow rate percentage (PEFR%) (p=0.0012), HCO_3 (p=<0.001) and pO_2 (p=0.0001) after the 2 weeks of intervention.

In contrary, a study by Rachna. D. Arora[10] the results showed that there was no statistically significant difference in RR(p=0.716), BHT(p=0.411), PEFR(p=0.36).

In current study, findings suggest that the intervention had discernible effects on metabolic function, as evidenced by shifts in pH, HCO3-, Paco2, and Pao2 levels in both the experimental and control groups. Similarly, in the study by El-Nahas et al. in 2019, the results of ABG showed significant improvement in experimental group as regard to all measured value (pH 1.32%, HCO3 12.39%, PaCO2 12.82%, PaO2 8.85%) while control group showed non-significant changes (pH 0.53%, HCO3 3.07%, PaCO2 3.6%, PaO2 0.67%).[23]

3. Association between respiratory parameters and demographic variables

In the present study it is observed that occupation is significantly associated with BHT and RR in experimental group and control group, respectively. Also in the study conducted by A.Lurdhu in 2018, none of the variables in the control group showed any statistically significant association with the mean differed level of respiratory parameters of the samples.[24]

In contrary, systematic review by Ashwini Verma, Risk factors like active and passive smoking, biomass fuel exposure, environmental tobacco smoke, occupational exposure

to dust, indoor and outdoor pollution, and increasing age were reported to have a significant association with COPD among Indian population.[3]

LIMITATIONS OF THE STUDY

1. All patients diagnosed with COPD were added who met with inclusion criteria irrespective of their level of risk and symptoms. Therefore, the pharmacological treatment of COPD patients varied according to their level of risk and symptoms.
2. No blinding

IMPLICATIONS OF THE STUDY

The researcher has drawn the following/ implications which can be applicable in different levels of nursing profession.

Nursing practice

1. This study shows that with proper training, a Buteyko breathing technique can be used to decrease breathing difficulty in chronic respiratory diseases.
2. Extending the quality of care providing by them.

Nursing education

3. This research study unwraps a new platform of knowledge and learning in the field of rehabilitation breathing techniques and its application.

4. It is opening a new scope for nursing in the light of Buteyko breathing technique. It can lead to outstand the nursing profession and the development of excellence.

Nursing research

5. this study adds evidence base on the effectiveness of Buteyko breathing technique on selected metabolic and pulmonary function parameters among COPD patients.

RECOMMENDATIONS

- The sample size and study duration can be increased for more reliable results.
- Further studies can be done using different variables.
- Similar study can be conducted in different setting (Private/Corporate hospitals)

CONCLUSION

The present study assessed the effectiveness of Buteyko Breathing Technique on metabolic and pulmonary function parameters among COPD patients visiting pulmonary OPD in AIIMS Bhopal. The study findings revealed that, regular practice of Buteyko Breathing Technique is helpful in improving breathing control, breath holding and reducing the work of breathing in subjects with Obstructive airway disease.

SUMMARY

This chapter includes major findings and discussion in relation with the reviewed literature, implications of the study, recommendations for future research are mentioned.

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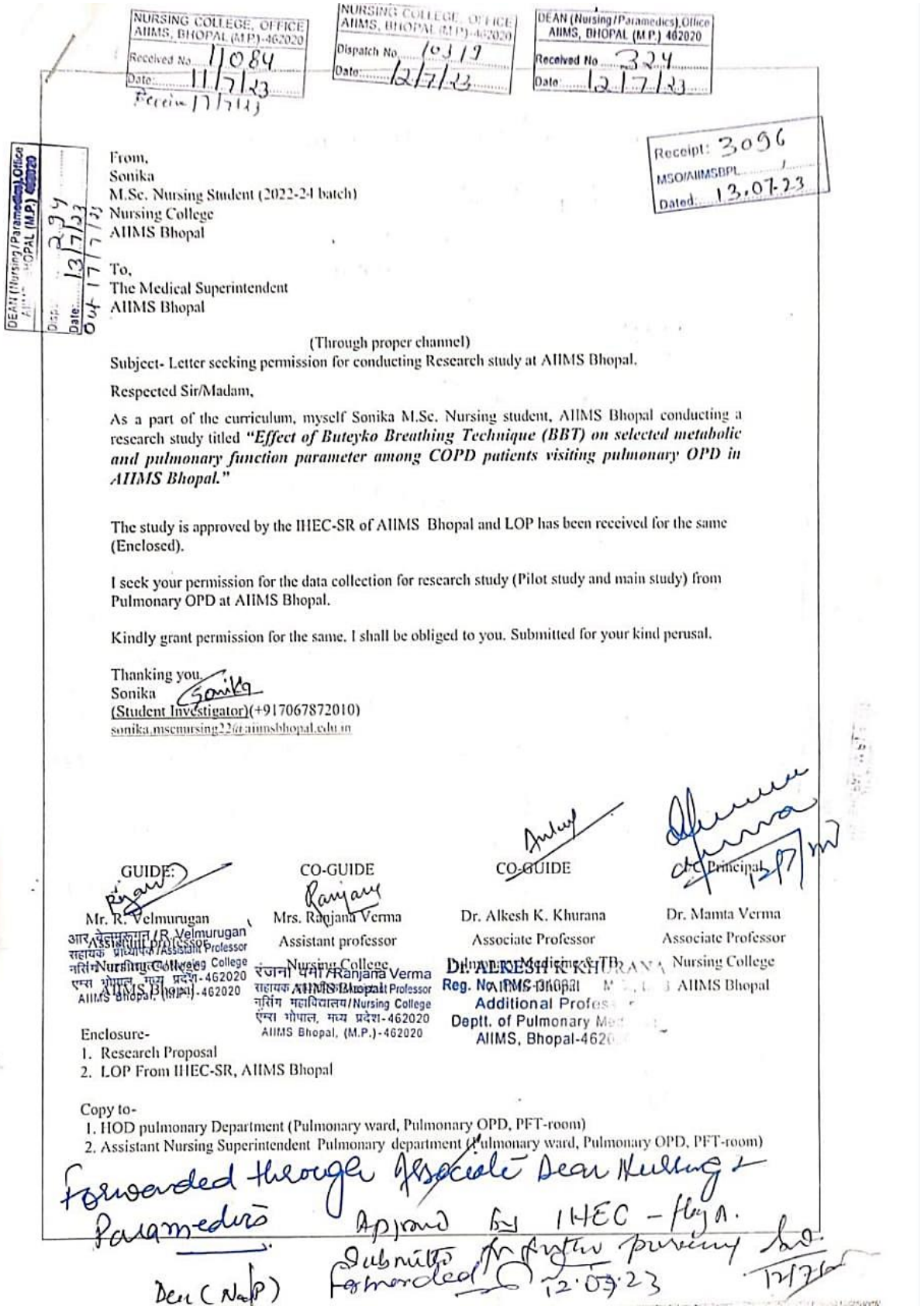
Annexure No:1

LETTER SEEKING PERMISSION TO CONDUCT STUDY



NURSING COLLEGE, OFFICE AIIMS, BHOPAL (M.P)-462020 Received No. 11084 Date: 11/7/23

NURSING COLLEGE, OFFICE AIIMS, BHOPAL (M.P)-462020 Dispatch No. 10319 Date: 12/7/23

DEAN (Nursing/Paramedics) Office AIIMS, BHOPAL (M.P.) 462020 Received No. 324 Date: 12/7/23

Receipt: 3096 MSO/AIIMSBPL Dated: 13.07.23

DEAN (Nursing/Paramedics) Office AIIMS BHOPAL (M.P) 462020 Dispatch No. 234 Date: 13/7/23

From,
Sonika
M.Sc. Nursing Student (2022-24 batch)
Nursing College
AIIMS Bhopal

To,
The Medical Superintendent
AIIMS Bhopal

(Through proper channel)

Subject- Letter seeking permission for conducting Research study at AIIMS Bhopal.

Respected Sir/Madam,

As a part of the curriculum, myself Sonika M.Sc. Nursing student, AIIMS Bhopal conducting a research study titled ***"Effect of Buteyko Breathing Technique (BBT) on selected metabolic and pulmonary function parameter among COPD patients visiting pulmonary OPD in AIIMS Bhopal."***

The study is approved by the IHEC-SR of AIIMS Bhopal and LOP has been received for the same (Enclosed).

I seek your permission for the data collection for research study (Pilot study and main study) from Pulmonary OPD at AIIMS Bhopal.

Kindly grant permission for the same. I shall be obliged to you. Submitted for your kind perusal.

Thanking you,
Sonika
(Student Investigator)(+917067872010)
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CO-GUIDE
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Pulmonary Medicine & TB
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Reg. No. AIIMS/BPL/2002
Additional Professor
Deptt. of Pulmonary Medicine & TB
AIIMS, Bhopal-462020

Dr. Principal
Dr. Mamta Verma
Associate Professor
Nursing College
AIIMS Bhopal

Enclosure-
1. Research Proposal
2. LOP From IHEC-SR, AIIMS Bhopal

Copy to-
1. HOD pulmonary Department (Pulmonary ward, Pulmonary OPD, PFT-room)
2. Assistant Nursing Superintendent Pulmonary department (Pulmonary ward, Pulmonary OPD, PFT-room)

Forwarded through Associate Dean Nursing & Paramedics

Approved by IHEC - Hqrs.

Submitted for kind perusal and forwarded 12.07.23

Dean (Nsg)

Annexure No: 2

SCREENING TOOL- ENGLISH

Screening tool for data collection

Code no

Date of assessment:

Address:

Contact number:

Instruction: encircle the appropriate response.

1.	Did the physician diagnosed the patient with COPD?	**Yes**	**No**
2.	Is the client more than 18 years of age?	**Yes**	**No**
3.	Whether the client understand Hindi, English or both?	**Yes**	**No**
4.	Do the client needs hospitalization due to COPD exacerbation?	**Yes**	**No**
5.	Whether the client is willing to participate or giving informed consent?	**Yes**	**No**
6.	Did the patient ever participated in breathing exercises?	**Yes**	**No**
7.	Have the patient undergone any spinal surgery in past 2 years?	**Yes**	**No**
8.	Is patient having other disease like TB, Heart failure, renal failure, neurological disease or psychiatric disease?	**Yes**	**No**
9.	Has the patient used bronchodilator in last 2 weeks?	**Yes**	**No**

Interpretation:

1.	Did the physician diagnosed the patient with COPD?	**Yes (Include)**	**No (Exclude)**
2.	Is the client more than 18 years of age?	**Yes (Include)**	**No (Exclude)**
3.	Whether the client understand Hindi, English or both?	**Yes (Include)**	**No (Exclude)**
4.	Do the client needs hospitalization due to COPD exacerbation?	**Yes (Exclude)**	**No (Include)**
5.	Whether the client is willing to participate or giving informed consent?	**Yes (Include)**	**No (Exclude)**
6.	Did the patient ever participated in breathing exercises?	**Yes (Exclude)**	**No (Include)**
7.	Have the patient undergone any spinal surgery in past 2 years?	**Yes (Exclude)**	**No (Include)**
8.	Is patient having other disease like TB, Heart failure, renal failure, neurological disease or psychiatric disease?	**Yes (Exclude)**	**No (Include)**
9.	Has the patient used bronchodilator in last 2 weeks?	**Yes (Exclude)**	**No (Include)**

Annexure No: 3

TOOL FOR DATA COLLECTION- ENGLISH

DATA COLLECTION TOOLS AND INSTRUMENTS

Part A: Tool for Demographic data collection

S.No.	ITEM	RESPONSE
1.	Age (in years)	Age in years 1. 41-50 2. 51-60 3. 61-70 4. 71-80
2.	Gender	1. □ Male 2. □ Female
3.	Educational qualification	1. □ Profession or honors 2. □ Graduate or Postgraduate 3. □ Intermediate or post high school diploma 4. □ High school certificate 5. □ Middle school certificate 6. □ Primary school certificate 7. □ Illiterate
4.	Occupation	1. □ Professional 2. □ Semi-professional 3. □ Clerical, shop owner 4. □ Skilled worker 5. □ Semi- skilled worker 6. □ Unskilled worker 7. □ Unemployed
5.	Height (in cm)	_____
6.	Weight (in kg)	_____
7.		1. □ Underweight <18.5 2. □ Normal 18.6-22.9 3. □ Overweight 23-24.9 4. □ Obese >25
8.	Family history of COPD	1. □ yes 2. □ no If yes, Relationship with member…. Duration of disease…….
9.	Cigarette smoking effect	1. □ yes 2. □ no If yes, Number of cigarettes per day …. Duration of cigarette smoking ….

Part B: Clinical sheet for recording

Pulmonary Function Parameter

Instruction: Assessment of Baseline Respiratory rate is followed by Breath Holding time before implementation of Buteyko breathing technique.

1) Respiratory Rate

Participant will be instructed to sit up straight in a comfortable position, then number of breaths taken in single minute will be recorded by observing chest movement (inspiration and expiration) with naked eyes of investigator for 1 minute. The baseline measurement will be repeated thrice within 10 min and the mean will be used for the observation.

	1st reading	2nd reading	3rd reading	MEAN
Sample 1				
Sample 2				
Sample 3				
Sample 4				
Sample 5				
Sample N				

2) Breath holding time

Participant will be instructed to sit quietly and breathe normally. Then they will be asked to breathe gently in and out. At the end of a normal exhalation the participant will be asked to pinch their noses and hold the breath as much as possible. The breath holding time will be the time where the participant is able to hold their breath, it will be recorded by observing chest movement (inspiration) or diaphragmatic movement with naked eyes of investigator. Measurement will be done with a stopwatch. The measurement will be repeated thrice within 10 min and the mean will be used for the observation.

	1st reading	2nd reading	3rd reading	MEAN
Sample 1				
Sample 2				
Sample 3				
Sample 4				

Sample 5				
Sample N				

3) Peak Expiratory Flow Rate

Instruction: PEFR will be assessed after assessing baseline RR and BHT.

1. The predicted PEFR: was calculated by the following equation:

PEFR (L/s) = [height (cm) – 80]* 5

2. Measurement of PEFR:

1) Install the disposable mouthpiece to the tip of the peak flow meter
2) Position the patient to stand or sit with his back upright and hold the peak flow meter horizontally without touching or disturbing the marker movement. Make sure the marker is in the lowest scale position (zero)
3) Encourage the patient to breathe as deep as possible, put it in the mouth
4) With the lips close tightly around the mouthpiece, exhale immediately as strong as possible
5) When exhaling, the marker moves and shows the number on the scale, noting the results.
6) Return the marker to zero position and
7) Repeat steps 2 to 4, thrice consecutively
8) Highest value will be selected for observation

3. The PEFR% was obtained by dividing the measured PEFR over the predicted PEFR and by it to 100 according to the following equation.

$$PEFR\ \% = \frac{measured\ PEFR}{Predicted\ PEFR} x100.$$

	1st reading	**2nd reading**	**3rd reading**	**HIGHEST**
Sample 1				
Sample 2				
Sample 3				
Sample 4				

Sample 5				
Sample N				

Part C: Clinical sheet for recording

Metabolic Parameter

Participant's ABG sample will be taken by the physician and analyzed values will be recorded.

	paCO2	**paO_2**	**HCO_3^-**	**pH**
Sample 1				
Sample 2				
Sample 3				
Sample 4				
Sample 5				
Sample N				

Part B: Clinical sheet for recording

Pulmonary Function Parameter

(Post-test)

Instruction: Assessment of Respiratory rate is followed by Breath Holding time after 2 weeks of implementing Buteyko breathing technique.

1) Respiratory Rate

Participant will be instructed to sit up straight in a comfortable position, then number of breaths taken in single minute will be recorded by observing chest movement (inspiration and expiration) with naked eyes of investigator for 1 minute. The measurement will be repeated thrice within10 min and the mean will be used for the observation.

Baseline Respiratory Rate				
	1st reading	**2nd reading**	**3rd reading**	**MEAN**
Sample 1				
Sample 2				
Sample 3				
Sample 4				
Sample 5				
Sample N				

2) Breath holding time

Participant will be instructed to sit quietly and breathe normally. Then they will be asked to breathe gently in and out. At the end of a normal exhalation the participant will be asked to pinch their noses and hold the breath as much as possible. The breath holding time will be the time where the participant is able to hold their breath, it will be recorded by observing chest movement (inspiration) or diaphragmatic movement with naked eyes of investigator. Measurement will be done with a stopwatch. The measurement will be repeated within 10 min and the mean will be used for the observation.

	1st reading	**2nd reading**	**3rd reading**	**MEAN**
Sample 1				

Sample 2				
Sample 3				
Sample 4				
Sample 5				
Sample N				

3) Peak expiratory flow rate

Instruction: PEFR will be assessed after assessing RR and BHT.

1. The predicted PEFR: was calculated by the following equation:

PEFR (L/s) = [height (cm) – 80]* 5

2. Measurement of PEFR:

1) Install the disposable mouthpiece to the tip of the peak flow meter
2) Position the patient to stand or sit with his back upright and hold the peak flow meter horizontally without touching or disturbing the marker movement. Make sure the marker is in the lowest scale position (zero)
3) Encourage the patient to breathe as deep as possible, put it in the mouth
4) With the lips close tightly around the mouthpiece, exhale immediately as strong as possible
5) When exhaling, the marker moves and shows the number on the scale, noting the results.
6) Return the marker to zero position and
7) Repeat steps 2 to 4, thrice consecutively
8) Highest value will be selected for observation

3. The PEFR% was obtained by dividing the measured PEFR over the predicted PEFR and by it to 100 according to the following equation.

$$PEFR\ \% = \frac{measured\ PEFR}{Predicted\ PEFR} x100.$$

	1st reading	**2nd reading**	**3rd reading**	**HIGHEST**
Sample 1				
Sample 2				

Sample 3				
Sample 4				
Sample 5				
Sample N				

Part C: Clinical sheet for recording

Metabolic Parameter

(post-test)

Participant's ABG sample will be taken by the physician and analyzed values will be recorded.

	paCO2	**paO_2**	**HCO_3^-**	**pH**
Sample 1				
Sample 2				
Sample 3				
Sample 4				
Sample 5				
Sample N				

Annexure No. 4

Participant Information Sheet

Title of the Study

A study to assess the effect of Buteyko Breathing Technique (BBT) on selected metabolic and pulmonary function parameter among COPD patients visiting pulmonary OPD in AIIMS Bhopal.

Student Investigator: Ms. Sonika M.Sc. Nursing Student (2022-2024)

Guide: - Mr. R. Velmurugan, Assistant Professor, Nursing College, AIIMS Bhopal

Co-Guide: 1) Mrs. Ranjana Verma, Assistant Professor, Nursing College, AIIMS Bhopal

2) Dr. Alkesh K. Khurana, Associate Professor, Pulmonary Medicine & TB AIIMS Bhopal

Introduction:

The research study aims to determine the effect of Buteyko Breathing Technique (BBT) on selected metabolic and pulmonary function parameter among COPD patients visiting pulmonary OPD in AIIMS Bhopal, as COPD is the third leading cause of death worldwide, causing 3.23 million deaths in 2019 and the Buteyko concept is a system of breathing exercises which is a complementary method of reliving respiratory symptoms based on the voluntary control of breathing. The objective of the study is to assess the selected metabolic and pulmonary function parameters among COPD patients in experimental and control group.

Purpose of study:

The purpose of this study to determine the effect of Buteyko Breathing Technique (BBT) on selected metabolic and pulmonary function parameters among COPD patients visiting in pulmonary OPD in AIIMS Bhopal.

Participation – what is included?

a. Do I have to take part?

Participation in this research is entirely voluntary. A decision to not take part, or withdraw at any time, will not affect your right or medical care in any way.

b. What is expected of me if I join?

If you agree to participate in the study, after taking informed consent, some questions will be asked to you regarding your personal data and metabolic, pulmonary function parameter such as ABG at room air, assessment of PEFR- peak expiratory flow rate, breath hold time and baseline respiratory rate which will not be disclosed to anyone. Then you will be randomly allocating to experimental group or control group. If you are coming under experimental group, you will be getting a demonstration of Buteyko breathing technique (BBT) which you will have to practice twice daily for a period of 2 weeks at your home and an activity worksheet will be provided in which you have to mention Yes or No about Buteyko breathing technique was performed or not. If you are coming under the control group then you will not receive Buteyko

breathing technique. After 2 weeks again the metabolic, pulmonary function parameters will be reassessed. The Time and place of the appointment for the treatment (to the experimental group) will be informed in person by the researcher

c. How long will my participation in the study last?

The duration of the participation lasts for 20-25 minutes

d. Do I have to come for extra visits or undergo extra investigation for the study?

NO.

e. What are the possible benefits in taking part?

Free education and demonstration of breathing exercise is given to you to decrease laboured breathing.

f. What are the possible disadvantages and risks of taking part?

There are no major foreseeable disadvantages or risk because of the study.

g. What happens to the information collected about me?

All information collected will be kept strictly confidential. Not share with anyone. Result from the study will be reported as group data and will not identify you in any way.

h. What happens if I change my mind about participating in this study?

You are entitled to change your mind and withdraw at any time during the study without any disadvantage or penalty.

i. Whom do I contact for more information or if I have further question or concerns?

If you want any information or have questions or concerns, you can contact

Ms. Sonika
Post graduate student
Nursing College,
AIIMS Bhopal
Ph: 7067872010
Email: sonika.mscnursing22@aiimsbhopal.edu.in

Dr. Shashank Purwar
Member Secretary,
Institution Human Ethics Committee-Student Research
Ph: 7773010099,
Email: ihecpgr@aiimsbhopal.edu.in

Annexure No: 5

PARTICIPANT INFORMED CONSENT FORM (PICF)

Participant identification number for this study: _____
Title of project: _____
Name of Student Investigator:_____Tel.No(s)._____
Name of Thesis Guide_____

The contents of the information sheet dated …….. that was provided have been read carefully by me / explained in detail to me, in a language that I comprehend, and I have fully understood the contents. I confirm that I have had the opportunity to ask questions.

The nature and purpose of the study and its potential risks / benefits and expected duration of the study, and other relevant details of the study have been explained to me in detail. I understand that my participation is voluntary and that I am free to withdraw at any time, without giving any reason, without my medical care or legal right being affected.

I understand that the information collected about me from my participation in this research and sections of any of my medical notes may be looked at by responsible individuals from AIIMS. I give permission for these individuals to have access to my records.

I agree to take part in the above study.

---------- Date:

(Signatures / Left Thumb Impression) Place:

Name of the Participant: _____

Son / Daughter / Spouse of:_____

Complete postal address: _____

This is to certify that the above consent has been obtained in my presence.

Signatures of the Principal Investigator Date:

Place:

1) Witness – 1 2) Witness – 2

Signatures
Name:
Address:

Signatures
Name:
Address:

Annexure No: 6

CERTIFICATE OF TRANSLATION

CERTIFICATE OF TRANSLATION

TO WHOM IT MAY CONCERN

This is to certify that Ms. Sonika, M Sc Critical Care Nursing student of Nursing College, AIIMS Bhopal is conducting research on topic "A study to assess the effect of Buteyko Breathing Technique (BBT) on selected metabolic and pulmonary function parameter among COPD patients visiting pulmonary OPD in AIIMS Bhopal". The Hindi version of Research tool, Screening tool, Participant Information Sheet (PIS) and Participant Informed Consent Form (PICF) for this study is a true and accurate translation of the English version and is valid to collect data for research

Seal & Signature Jyoti

JYOTI MALIK
Ex. Principal
P.L. Montessori
Lko.

Name of the language expert Jyoti Malik

Designation Ex. Principal (P.L. Montessori Inter College, Lko)

Qualification MA, B.Ed

Date 8/10/2023

Place LUCKNOW

Annexure No: 7
LIST OF EXPERTS IN CONTENT VALIDATION

S. No.	Name of the Expert	Designation	Institution
1.	Dr. Anurag Bhai Patidar	Associate Professor	Nursing college, AIIMS Bhopal
2.	Dr. Jisa George T	Assistant Professor	Nursing college, AIIMS Bhopal
3.	Mr. Kuamarasamy AP.	Assistant Professor	Nursing college, AIIMS Bhopal
4.	Mr. Maneesh Sharma	Assistant Professor	Nursing college, AIIMS Rishikesh
5.	Mr. Mahalingam	Associate Professor	Nursing college, AIIMS Bhubaneshwar
6.	Dr. Sofia Mudda	Medical Officer	AYUSH dept. AIIMS Bhopal
7.	Mr. Sarvesh K. Dhakar	Assistant Nursing Superintendent	Modular OT, AIIMS Bhopal
8.	Mr. Midhun Kumar. M	Assistant Nursing Superintendent	MICU, AIIMS Bhopal
9.	Mr. Kanhaiyalal Rathore	Assistant Nursing Superintendent	MICU, AIIMS Bhopal
10.	Mr. Devesh Dheva	Nursing officer	MICU, AIIMS Bhopal

Annexure No: 8

CONTENT VALIDITY LETTER WITH CRITERIA

LETTER REQUESTING EXPERTS OPINION AND SUGGESTIONS FOR THE CONTENT VALIDITY OF RESEARCH TOOL

Date:

From,
Sonika
M.Sc. Nursing (Batch 2022-24)
Nursing college, AIIMS Bhopal.

To,
.....
.....
.....

Subject: Requesting the expert's opinion and suggestion for the content validity of research tool

Respected Sir/ Madam,

I, Sonika, M.Sc. Nursing (Batch 2022-24) student in Critical Care Nursing at Nursing College of AIIMS Bhopal. I have selected the topic mentioned below for my dissertation to be submitted as partial fulfillment of Masters in Nursing Degree programme, at the nursing college, AIIMS Bhopal.

Title of the study: "A study to assess the effect of Buteyko Breathing Technique (BBT) on selected metabolic and pulmonary function parameter among COPD patients visiting pulmonary OPD in AIIMS Bhopal"

In this regard I have prepared the following:

1. Self-structured tool for data collection in English
2. Clinical sheet for recording Pulmonary function parameter
3. Clinical sheet for recording Metabolic Parameter

May I request you to kindly go through the content and give your valuable remarks and suggestions for any modification needed. I also plea you to accept the request and sign the enclosed certificate of validation.
I shall be grateful to you for your valuable remarks and suggestions.

Thanking you in anticipation.
Yours sincerely,

Sonika
M.Sc. Nursing (Batch 2022-24)

GUIDE
Mr. R. Velmurugan
Assistant Professor
College of Nursing
AIIMS Bhopal, (M.P.)-462020

Co-Guide
Mrs. Ranjana Verma
Assistant Professor
College of Nursing,
AIIMS Bhopal

Dr. Mamta Verma
I/C PRINCIPAL
Nursing College,
AIIMS Bhopal

Enclosed with: Letter of permission, Brief synopsis, detailed intervention, Research tool, Criteria checklist for content validity of the tool, Certificate of validation.

CRITERIA FOR VALIDATION – TOOL OF THE STUDY

Part A: Tool for Demographic data collection

The tool contains 7 items regarding sociodemographic data. We need your expert judgement on degree of relevancy of each item to the measured domains. If there are any suggestions, please mention in the remark column.

S.No	Item number	Highly relevant 4	Quite relevant 3	Somewhat relevant 2	Not relevant 1	Remarks
1.	**Age (in years)** _____					
2.	**Gender** 1. Male 2. Female 3. others					
3.	**educational qualification** □ Profession or honors □ Graduate or Postgraduate □ Intermediate or posthigh school diploma □ High school certificate □ Middle school certificate □ Primary school certificate □ Illiterate					
4.	**Occupation** □ Professional □ Semi-professional □ Clerical, shop owner □ Skilled worker □ Semi- skilled worker □ Unskilled worker □ Unemployed					

5.	**Height (in cm)** **_____**					
6.	**Weight (in kg)** **_____**					
7.	**BMI** 1. Underweight <18.5 2. Normal 18.6-22.9 3. Overweight 23-24.9 4. Obese >25					
8.	**Family history of COPD** 1. yes 2. no **If yes,** Relationship with member…….. Duration of disease……..					
9.	**Cigarette Smoking Habit** 1. Yes 2. No **If yes,** Number of cigarettes per day…….. Duration of cigarette smoking…….					

Part B: Clinical sheet for recording

Pulmonary Function Parameter

The Clinical sheet for recording Pulmonary function parameter contains 3 items respectively. We need your expert judgement on degree of relevancy of each item to the measured domains. If there are any suggestions, please mention in the remark column.

S.No	Item number	Highly relevant 4	Quite relevant 3	Somewhat relevant 2	Not relevant 1	Remarks
1.	Respiratory rate (mean value)					
2.	Breathe holding time (mean value)					
3.	Peak expiratory flow rate (highest value)					

Part C: Clinical sheet for recording

Metabolic Parameter

The Clinical sheet for recording Metabolic parameter contains four components. We need your expert judgement on degree of relevancy of each item to the measured domains. If there are any suggestions, please mention in the remark column.

S.No	Item number	Highly relevant 4	Quite relevant 3	Somewhat relevant 2	Not relevant 1	Remarks
1.	ABG at room air ▪ PaO_2 ▪ $PaCO_2$ ▪ HCO_3 ▪ pH					

Annexure No: 9

CERTIFICATE OF VALIDATION

Certificate of validation

This is to certify that the tool prepared by Sonika, M.Sc. Nursing 2022 batch student, Nursing college, AIIMS Bhopal, to be used in her study titled **"A study to assess the effect of Buteyko Breathing Technique (BBT) on selected metabolic and pulmonary function parameter among COPD patients visiting pulmonary OPD in AIIMS Bhopal"** has been validated by me and is found to be **valid/ not valid.**

Overall Remark-

Signature:

Name of the expert:

Designation:

Name of the Institution:

Official seal:

Date:

Place:

Annexure No: 10

Buteyko breathing technique – Intervention protocol

Buteyko breathing technique aims to reduce hyperventilation through periods of controlled reduction in breathing, known as 'slow breathing' & 'reduced breathing', combined with periods of breath holding, known as 'control pause'.

Primary aim of the breathing techniques is to raise carbon dioxide levels.

In case of hyperventilation there is a proportionate exhalation of carbon dioxide as to the inhalation of oxygen, leading to a decline in the net amount of carbon dioxide in blood. Thus, there is less oxygen supply leading to weak health and chronic disease.

Procedure

Patient preparation

- Greet the patient and introduce yourself.
- Explain the procedure to the patient.
- Place the patient in comfortable sitting

Environment preparation

- Time should be convenient for investigator and the participant
- Area should be well lighted.
- Room should be warm enough to be comfortable for the client
- Positioning of the patient in upright position on a chair

➢ **Phase 1- Pre-exercise phase (3 mins)**

- Mindful breathing for 1 min
- Breath in with neck extension and breath out with neck flexion for 1 min.
- Again, mindful breathing for 1 min.

➢ **Phase 2- Exercise phase (15 min)**

- Step 1) Gently breath out through nose.
- Step 2) Pinch nose with fingers to hold breath
- Step 3) Hold breath as long as possible
- Step 4) Release nose and resume breathing
- Step 5) Calm breathing as soon as possible
- Step 6) Wait 30-60 seconds. Repeat twelve times.

➢ **Phase 3- Post exercise phase (2 min)**

- Take a rest with normal breathing for 2 min.

Annexure No: 11

Certificate of Buteyko breathing technique training

udemy

Certificate no: UC-f79bff95-98dd-4305-8f7e-f7bc7b8ec281
Certificate url: ude.my/UC-f79bff95-98dd-4305-8f7e-f7bc7b8ec281
Reference Number: 0004

CERTIFICATE OF COMPLETION

Learn The Buteyko Breathing Method

Instructors **Maria Shapley**

Sonika

Date **July 31, 2023**
Length **5.5 total hours**

ANNEXURE NO. 12

Activity Worksheet (English)

Activity worksheet

If the exercise is performed, put a (✓) or (×) in the respective box on the respective day. Kindly fill the space as per your activity done truthfully and honestly.

	ACTIVITY DONE		Follow-up call/text by researcher
	MORNING Yes or NO (✓ or ×)	EVENING Yes or NO (✓ or ×)	
Day 1			
Day 2			
Day 3			
Day 4			
Day 5			
Day 6			
Day 7			
Day 8			
Day 9			
Day 10			
Day 11			
Day 12			
Day13			
Day 14			

ANNEXURE NO. 13

Activity Worksheet (Hindi)

गतिविधि वर्कशीट

यदि व्यायाम किया जाता है, तो संबंधित दिन संबंधित बॉक्स में (✓) या (×) लगाएं। कृपया सच्चाई और ईमानदारी से की गई अपनी गतिविधि के अनुसार स्थान भरें।

	गतिविधि की गई		शोधकर्ता द्वारा अनुवर्ती कॉल/पाठ
	सुबह हाँ या नहीं (✓ या ×)	शाम हाँ या नहीं (✓ या ×)	
दिन 1			
दिन 2			
दिन 3			
दिन 4			
दिन 5			
दिन 6			
दिन 7			
दिन 8			
दिन 9			
दिन 10			
दिन 11			
दिन 12			
दिन13			
दिन 14			

ANNEXURE NO. 14

Random Number Table

A	B
1	4
2	5
3	6
7	12
8	13
9	15
10	18
11	19
14	21
16	22
17	24
20	26
23	30
25	31
27	36
28	37
29	39
32	40
33	42
34	43
35	47
38	49
41	51
44	52
45	53
46	55
48	56
50	58
54	59
57	60

ANNEXURE NO. 15

Mastersheet

Group	Age	Gender	Education	Occupation	Height	Weight	BMI	Family history	Smoking	RR		BHT		PEFR%		pH		HCO3		pCO2		pO2	
										pre	post	pre	post	pre	post	pre	post	pre	Post	pre	post	pre	post
1	3	1	5	6	160	54	2	2	1	29	26	13	18	72	78	7.55	7.45	19.37	21.78	46.64	40.66	70.37	78.79
1	2	1	5	5	166	58	2	2	1	18	16	15	19	68	74	7.46	7.36	19.32	21.72	42.64	40.62	72.39	72.89
1	2	1	3	5	158	42	1	2	1	28	24	13	17	72	74	7.5	7.4	18.99	22.03	48.05	40.05	72.37	78.79
1	2	1	5	5	164	58	4	2	1	31	27	12	15	52	60	7.49	7.39	18.9	22.02	49.05	42.05	74.89	80.82
1	2	1	5	6	164	56	2	2	1	28	24	15	19	62	66	7.5	7.4	19.23	21.22	48.66	42.66	72.24	76.24
1	2	1	6	5	164	47	1	2	1	29	24	13	19	60	68	7.48	7.38	21.23	21.24	48.64	42.64	76.33	78.33
1	3	1	5	7	165	58	2	2	1	29	23	8	13	66	68	7.5	7.4	22.22	21.23	48.64	42.64	72.24	78.24
1	1	1	5	3	163	50	2	2	1	19	18	14	17	72	78	7.52	7.42	19.22	22.22	46.64	36.64	74.34	78.34
1	3	1	4	7	152	46	2	2	1	27	23	15	17	74	86	7.54	7.44	18.05	21.06	48.68	40.68	70.39	78.34
1	3	1	4	5	152	48	2	2	1	31	23	13	20	48	58	7.48	7.38	19.22	21.22	46.64	40.66	70.22	78.36
1	2	1	3	3	158	50	2	2	1	29	22	24	25	60	78	7.52	7.42	18.05	21.05	48.64	42.64	72.32	80
1	1	1	2	3	158	47	2	2	1	31	27	12	19	72	76	7.54	7.44	19.02	22.02	48.64	42.64	70.2	78.2
1	3	1	5	5	160	54	3	2	1	28	23	13	19	70	78	7.55	7.44	19.03	18.02	49.62	43.64	72.02	78.02

1	2	1	4	5	158	60	4	2	1	17	15	13	19	64	76	7.5	7.4	18.05	19.05	47.8	40.8	70.02	78.02
1	3	1	5	7	145	38	1	2	1	30	23	23	26	68	76	7.4	7.3	19.01	20.01	48.64	40.64	72.05	78.05
1	2	1	4	5	149	40	1	2	1	19	16	13	17	70	78	7.45	7.35	18.03	21.02	46.64	40.66	70.08	78.08
1	3	1	5	7	146	38	1	2	1	29	23	12	19	48	66	7.55	7.45	19.02	21.02	49.05	42.05	70.02	78.02
1	2	1	4	6	165	52	2	2	1	29	23	13	17	64	68	7.52	7.32	19.03	21.03	48.05	40.05	70.02	78.02
1	2	1	4	6	164	52	2	2	1	27	27	15	20	74	68	7.5	7.4	18.02	22.22	48.05	40.05	68.02	74.02
1	2	1	5	5	162	56	2	2	1	14	18	13	20	72	78	7.48	7.38	19.02	21.78	46.64	40.62	72.02	78.02
1	3	1	5	5	161	56	2	2	1	29	23	14	20	74	78	7.46	7.36	19.37	21.78	49.05	42.04	74.02	78.02
1	2	2	6	7	154	45	2	2	2	28	23	15	22	76	76	7.5	7.4	18.37	22.03	48.05	40.05	72.02	80.02
1	3	1	5	5	161	56	2	2	1	29	22	13	17	72	81	7.49	7.39	19.36	22.04	46.64	40.66	70.36	78.02
1	2	2	7	7	149	38	1	2	2	27	24	9	15	72	81	7.5	7.4	19.39	22.05	48.05	40.05	70.28	78.02
1	2	2	7	7	154	42	1	2	2	24	20	13	19	74	74	7.48	7.38	19.36	19.34	49.05	42.05	73.38	75.02
1	3	1	4	4	163	56	2	2	1	16	19	15	19	70	78	7.5	7.44	18.05	21.22	48.05	40.05	70.37	78.49
1	2	1	5	5	159	46	1	2	1	30	22	13	19	60	78	7.58	7.48	19.02	21.35	46.64	40.62	70.37	79
1	2	1	4	6	161	52	2	2	1	18	16	21	22	64	78	7.55	7.45	18.06	22.02	48.05	40.05	72.32	78.05
1	2	1	5	6	159	44	1	2	1	30	22	13	19	60	64	7.54	7.46	19.05	21.05	46.64	42.64	70.37	78.79
1	2	1	3	4	154	44	2	2	1	26	20	12	18	64	68	7.44	7.38	19.02	21.33	48.05	42.05	73.9	80.22
2	2	2	6	5	156	47	2	2	2	29	28	15	17	66	66	7.55	7.52	19.37	20.12	46.64	45.54	72.5	76.5
2	2	1	5	5	156	42	1	2	1	29	26	14	15	54	58	7.46	7.44	19.52	20.12	47.78	46.64	74.5	76.5

2	3	1	4	7	155	40	1	2	1	31	29	13	15	68	70	7.5	7.48	19.42	20.32	47.78	46.66	72.3	76.7
2	3	1	4	5	164	58	2	2	1	29	27	11	15	72	75	7.49	7.46	18.32	19.21	46.64	45.54	76.2	76.4
2	3	1	4	7	166	59	2	2	1	19	18	13	15	64	66	7.55	7.53	18.52	19.12	44.64	42.64	74.4	75.3
2	3	1	5	5	164	52	2	2	1	29	27	13	15	68	70	7.45	7.42	19.37	20.12	42.62	40.62	75.5	76.4
2	2	1	3	5	159	50	2	2	1	29	29	9	13	58	60	7.55	7.52	18.52	19.11	47.72	40.62	74.4	76.3
2	3	1	5	5	154	44	1	2	1	29	29	13	15	74	78	7.56	7.54	19.44	20.12	46.64	46.62	75.5	76.4
2	3	1	5	7	146	32	1	2	1	16	17	14	15	66	68	7.44	7.42	18.32	19.03	42.24	45.64	74.9	76.9
2	2	2	5	7	154	46	2	2	1	31	30	24	25	68	72	7.46	7.44	19.37	19.52	44.54	40.24	72.2	76.3
2	2	1	5	5	159	44	1	2	1	29	27	13	16	64	68	7.48	7.46	19.52	20.12	44.52	42.52	74.5	74.3
2	2	1	5	5	156	42	1	2	1	17	19	13	15	47	51	7.54	7.52	19.52	20.12	46.64	42.52	72.3	75.5
2	2	1	5	5	160	52	2	2	1	29	28	12	17	64	67	7.53	7.51	19.49	20.12	44.42	45.64	72.5	76.5
2	3	1	5	3	162	58	2	2	1	31	30	13	15	72	77	7.48	7.46	18.32	19.52	46.64	41.44	74.5	76.3
2	3	1	5	6	162	57	2	2	1	16	14	8	13	68	70	7.44	7.42	19.03	20.12	45.54	45.54	74.4	76.3
2	2	1	5	5	159	44	1	2	1	28	27	13	15	74	77	7.46	7.44	19.36	20.22	46.64	44.44	76.2	78.5
2	3	1	6	7	159	44	1	2	1	17	18	14	15	70	73	7.5	7.48	19.39	20.12	42.24	44.62	72.5	76.5
2	3	1	6	6	158	44	1	2	1	30	27	12	15	74	81	7.46	7.44	18.32	19.39	44.42	44.24	73.3	76.3
2	2	2	5	7	154	42	1	2	2	31	30	13	15	68	70	7.46	7.42	19.32	20.12	46.64	42.24	74.4	76.43
2	2	2	7	7	156	44	1	2	2	27	29	13	16	62	62	7.5	7.48	19.39	20.22	44.42	43.64	76.4	78.5

2	4	1	5	5	162	58	2	2	1	17	15	23	26	66	68	7.52	7.5	19.36	20.12	46.64	44.62	72.5	74.5
2	2	1	7	5	154	46	2	2	1	29	29	15	15	49	54	7.5	7.48	19.39	20.12	44.64	42.62	72.4	73.3
2	3	2	7	5	158	47	2	2	1	30	31	13	16	62	63	7.52	7.5	19.37	20.12	47.78	46.78	74.4	76.3
2	2	1	4	5	146	38	1	2	1	31	31	10	14	52	55	7.54	7.52	19.42	20.32	42.24	40.24	74.4	76.5
2	2	1	4	5	149	40	1	2	1	15	17	15	16	54	57	7.48	7.46	19.36	20.14	44.24	43.9	76.4	77.5
2	2	2	5	7	145	30	1	2	2	29	26	15	16	60	64	7.5	7.48	19.39	20.12	42.34	41.31	72.4	72.4
2	2	1	6	3	154	44	1	2	1	31	29	13	16	62	64	7.52	7.5	19.52	20.22	44.49	44.52	72.5	75.4
2	3	1	7	7	146	32	1	2	1	29	27	19	15	64	66	7.48	7.46	18.32	19.21	47.78	46.64	74.5	76.4
2	3	1	6	6	158	44	1	2	1	29	29	13	14	48	52	7.44	7.42	19.36	20.12	47.78	46.66	72.3	75.7
2	3	1	5	6	161	57	2	2	1	29	27	13	15	66	69	7.55	7.53	19.37	20.12	44.64	42.64	73.54	75.4

MASTER DATA SHEET KEY

Demographic variables	Category	Coding
Age (in years)	41-50 51-60 61-70 71-80	1 2 3 4
gender	Male Female	1 2
Educational qualification	Profession or honors Graduate or Postgraduate Intermediate or post high school diploma High school certificate Middle school certificate Primary school certificate Illiterate	1 2 3 4 5 6 7
occupation	Professional Semi-professional Clerical, shop owner Skilled worker Semi- skilled worker Unskilled worker Unemployed	1 2 3 4 5 6 7
BMI	Underweight <18.5 Normal 18.6-22.9 Overweight 23-24.9 Obese >25	1 2 3 4
Family history of COPD	Yes No	1 2
Cigarette smoking effect	Yes No	1 2
Pulmonary function parameter		
RR **BHT** **PEFR%**	Respiratory rate Breath holding time Peak expiratory rate %	. . .
Metabolic parameter	pH HCO3 pO2 pCO2	. . . .